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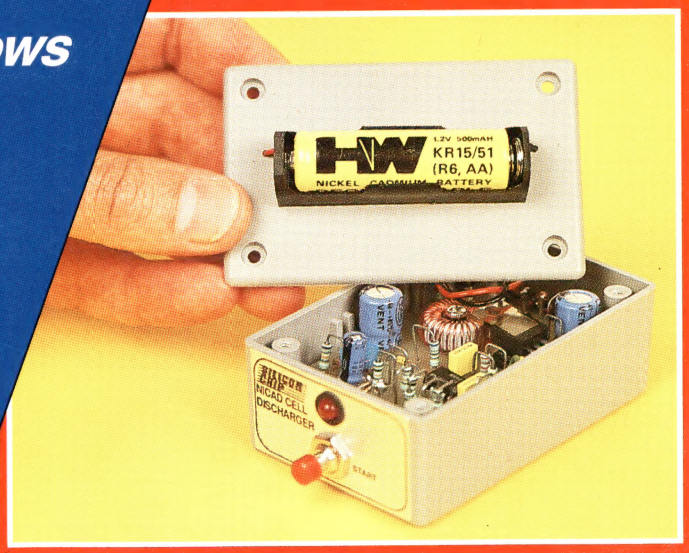
Alphanumeric LCD Demonstration Board

Remote Volume Control For Hifi Systems

Hifi Review: Dynaudio Image 4 Loudspeakers

ow-Cost Mini Gas Laser



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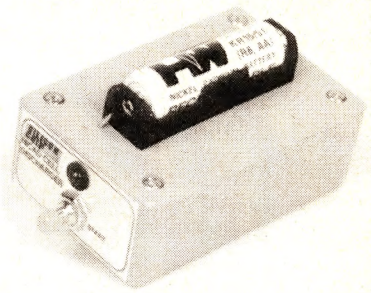
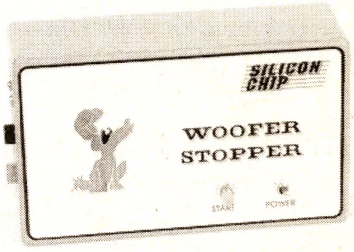
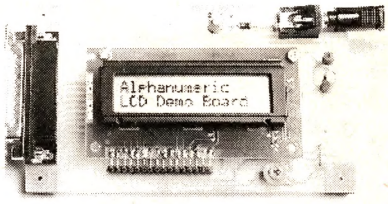


REJUVENATE THOSE TIRED nicad cells with this simple project. It will correctly discharge any nicad cell so that it can then be recharged to full capacity – see page 20.



ZAP THAT BARKING DOG next door with the Woofer Stopper. It produces a retaliatory high energy supersonic (20kHz) tone that discourages further barking. Turn to page 26.

THIS TRANSMITTER & its companion receiver will let you adjust the volume & channel balance of your stereo system from the comfort of your armchair. Details page 32.



BUILD THIS PROJECT & find out how alphanumeric LCD panels work. It interfaces to the printer port of your PC – see page 64.

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PUBLISHER'S LETTER

SILICON CHIP To Be Published In The USA

This month, we have a range of interesting projects for readers to build but two are especially noteworthy. The first is the "Woofer Stopper" which may have a whimsical name but it is intended to help solve the very common problem of barking dogs. It is a great pity that so many people are bothered by barking dogs, particularly as the dog owners either are oblivious to the problem or deny that their little darlings ever bark.

As presented, the "Woofer Stopper" can be very effective against dogs that are close to your home, say within 20 or 30 metres. In that situation, it can work like a charm and without the offending dog owner even knowing that you have taken action. On the other hand, the "Woofer Stopper" is a partial solution to what is really a sociological problem. In the long term, I hope that people and municipal councils will come to recognise that unless dogs are properly disciplined and are not left alone for long periods every day, they do become a nuisance.

Our second project which is worthy of note is the "Remote Volume Control" which is based on a 68HC705C8P microprocessor. At first sight, this may seem like a complicated alternative to the remote controlled motor-driven volume controls now seen in many domestic hifi systems. However, it solves the problems of having to obtain special volume and balance pots and is a superior solution as far as performance is concerned. It also represents a step forward for us in that we can now present dedicated microprocessor projects and we will be supplying the programmed microprocessors to kit sellers and individual readers.

And finally, we have some news of an even bigger step forward. In the near future, SILICON CHIP will be published in the United States and Canada. Gernsback Publications, Inc of New York, who presently publish *Popular Electronics* and *Electronics Now* (formerly *Radio Electronics*), will initially be publishing four issues a year of SILICON CHIP and most of the editorial will be reproduced from Australian issues.

Naturally, we are delighted to be able to announce this development, as it will give us a boost both locally and overseas. To our knowledge, it is the first time an Australian magazine, technical or otherwise, has been licensed for publication in the USA.

Leo Simpson

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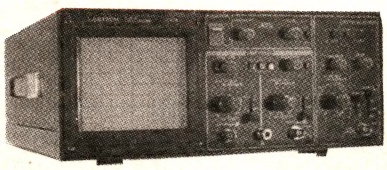

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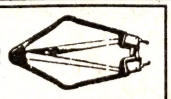

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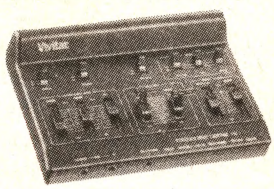

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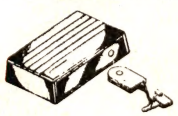

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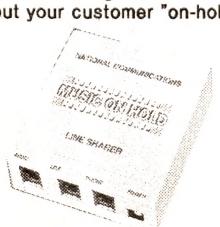

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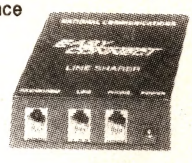

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Dynaudio Image 4 2-way loudspeakers

The Dynaudio Image 4 is a large tower speaker with just two drivers, a 28mm tweeter & a 20cm woofer with bass reflex loading. It is rated to handle amplifiers up to 180 watts per channel & has a very smooth frequency response.

By LEO SIMPSON

Large 2-way loudspeakers are relatively unusual. The trend is for larger speakers to have three, four or even more drivers. This is sometimes done deliberately so that buyers feel that they are getting more value for their money but it does not necessarily result in better sound. The design philosophy behind the Dynaudio Image 4s is that more is not better.

Many loudspeaker systems on the market do not have any useful bass response below 50Hz so these Dynaudio Image 4 loudpeakers are unusual in this respect too. They have a very smooth response which extends down to below 30Hz – almost a full octave below 50Hz. The difference that can make is sensational.

But why go to a tower loudspeaker. The overwhelming fashion among loudspeaker designers today is to produce small 2-way systems which have to be mounted on stands if they are to give the best performance. The stand brings the tweeter up to about the ear level of the seated listener and thereby ensures that he or she is sitting almost "on axis" with the tweeter. Thus, the listener gets to hear every little nuance produced by the tweeter.

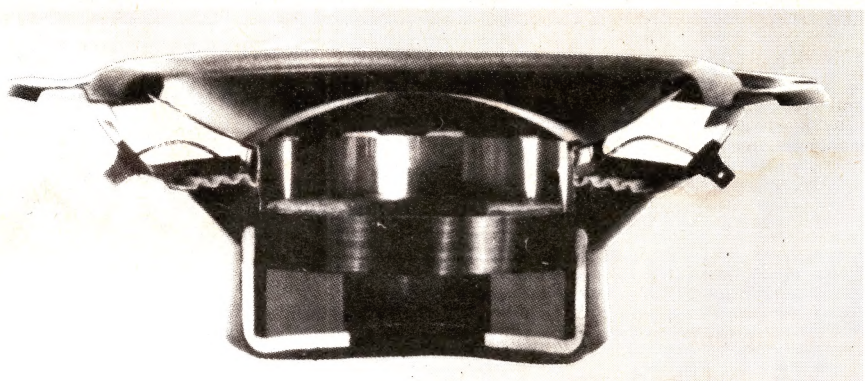
Although small loudspeakers c also conveniently sit on a bookshe they usually don't give the best r sults in this position because they a too close to the walls or corners of t room. This tends to muddy the ba and lower midrange. So it is back t having stands for the best results.

Now while having small speake on stands is necessary if they are t produce their best, it also means tha they occupy more floor space tha their small size would indicate. Th stands inevitably must be quite heav and their "foot print" is quite large t avoid having them easily tipped over Thus, the typical loudspeaker stanc has a footprint which is 25 to 30cm wide and 30 to 35cm deep.

With the above factors in mind, a tower loudspeaker starts to make a great deal of sense. It doesn't occupy a lot of floor space and it doesn't need a stand since it is already tall. The tower concept also means that the designer can settle for a much larger enclosure and thus obtain a much better bass response than would be possible – all other things being equal. The trouble is, some tower speakers don't look attractive at all.

However, by any normal standards, the Dynaudio Image 4s are impressive to look at. The designers have managed to design a large loudspeaker without producing one that dominates a room. As a tower speaker, it is quite tall at 950mm high but its width of 270mm and its depth of 325mm means that it occupies no more floor-space than typical bookshelf style speakers mounted on stands.

A contributing factor to its grace rather than gross is that the grille cloth



This cross-section of the Dynaudio 24-W-100 shows its unusual construction. The voice coil is 100mm in diameter and the circular magnet is ventilated to prevent pressure build-up under the large dust cap. The inside-out construction of the magnet means that flux leakage is low & the speakers can be used close to TV monitors.

e does not cover entire front of abinet, leaving more than a third e veneered panel visible. I should at the outset that the Image 4s available in two genuine timber eer finishes: black Ash and Mahany. This reddish timber is somet lighter than the Rosewood which d to be a popular furniture finish ny years ago. In this reviewer's nion, the Mahogany finish is a detful contrast to the dreary black of lay's speakers.

Removing the grille cloth frame reals that the Image 4s are simply a 2-y bass reflex design with a 28mm ft dome tweeter and 200mm (8-inch) oofer with a polypropylene cone and am rubber roll surround. However, ere is far more to it than that beuse both drivers turn out to be "speals", produced to meet the requirents of the Australian design team, len Leembruggen and David Connor.

The immediately noticeable feature f the woofer is its very large dust ap. That conceals a voice coil which s 100mm in diameter. This must be a ecord for virtually any loudspeaker lriver. The upshot is that the voice coil can dissipate very large amounts of power without becoming excessively hot and this means that "dynamic compression" is greatly reduced. In conventional loudspeakers, high power dissipation causes the voice coil resistance to rise and thus the speakers do not respond linearly to loud signals – they are compressed.

Dynaudio claim that the 24-W-100 woofer used in the Image 4s will faithfully reproduce a 1000 watt 10 millisecond transient. If that sounds remarkable, they make the same claim for the matching D-28-AF tweeter!

On the rear panel, the Image 4 has a recessed terminal panel with large gold-plated binding posts which can take really massive loudspeaker cables or banana plugs. Furthermore, there are two pairs of terminals which are normally connected in parallel with gold plated straps. With the straps removed, you have the option of bi-wiring or bi-amping.

Personally, I cannot see the point of bi-wiring. In effect, you use separate pairs of leads to power the tweeter and woofer and thereby supposedly reduce any interaction between high and low frequency signals as they pass along the cable. To anyone with a knowledge of AC circuit theory, and more particularly the Superposition theorem, this is rubbish.

Pictured are two units in the Dynaudio Image range: the large Image 4s (right), subject of this review, & the Image 3 which uses the same D-28-AF tweeter.

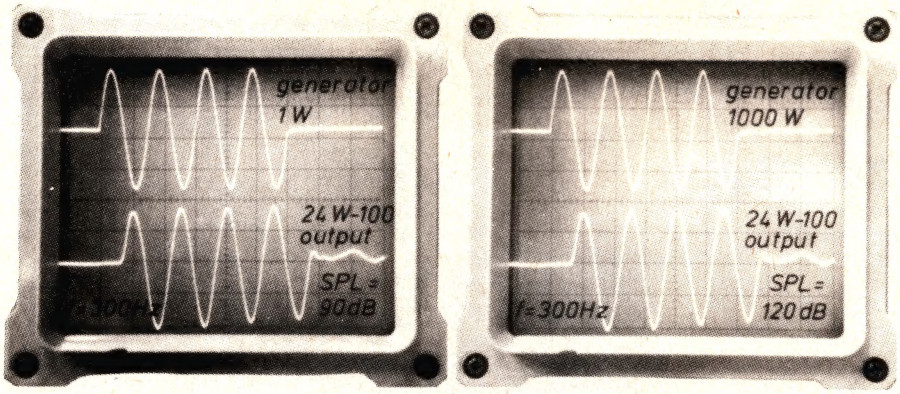
Note that whether you elect to "bi-wire" or "bi-amp" your loudspeakers, the normal crossover components remain in place. In addition, a bi-amp system (ie, two separate power amplifiers in each channel) requires an electronic crossover and its inevitable phase shifts at the crossover frequency will be added to those already produced by the loudspeaker's own filter network. These additional variances cannot be allowed for by the designers and therefore the results will not be as good as if the speaker was used in the conventional fashion.

Some reviewers have argued that bi-wiring means less voltage drop for the signals to the tweeter and woofer but even that is not true, although it would take more space than can be spared to prove this argument.

To me, the only reason for including the bi-wiring facility is to satisfy the hifi faddists, those golden eared types who hear an improvement after every fiddle and tweak.

Whether or not you agree with the idea of bi-wiring, bi-amping or other gimmicks, the connecting terminals for these Image 4s are beauties and they should be a feature of any loudspeaker that claims high performance – you really do need them if you are to use heavy speaker cables and thereby obtain the best sound quality. Lest any reader think that I am against heavy speaker cables, let me reassure you on that score. I believe that the lower the resistance of the speaker cables, the better. Again, I don't have space to go into the reasons why and nor are they the ones necessarily espoused in hifi magazines.

The highest quality components have also been used in the crossover filters (air-cored inductors, etc). The



These scope photos show the enormous power handling capability & dynamic range that these speakers have. They can reproduce a 1000 watt transient with no dynamic compression.

crossover network is a third order Chebyshev filter for the tweeter and a 6dB/octave filter for the woofer. The crossover frequency is 2.5kHz. By the way, the Image 4 is specified as having a nominal impedance of 6 ohms. The minimum impedance is 4 ohms and occurs at just under 3kHz.

On a practical note, the Image 4s are unwieldy to lift and move about. While they are not particularly heavy at around 27kg, there is nowhere to grasp them. The baffle is completely flush when the grille is removed. In fact, I resorted to lifting them by putting one hand inside the port – there is no other practical hand hold.

Listening tests

As noted above, relatively few loudspeakers have a response extending below 50Hz and those that go below 30Hz are rare indeed. The Image 4s have a frequency response quoted at 36Hz to 25kHz within ±3dB. That is exceptional enough in itself but it also means that the usable bass in a typical living room can be expected to be below 30Hz.

Our listening tests on constant sinewaves indicate that the Image 4s do have a very smooth and extended frequency response right up to the limit of audibility and yes, it really is usable down to below 30Hz, with very little tendency to frequency doubling (ie, tending to second harmonic distortion) at moderate power levels. In other words, the bass is very clean and when compared to many other largish speakers, quite restrained.

For its part, the tweeter is exceptionally smooth and the crossover does its work well, with little sign of "suck-out" or phasing problems. The cabinet is also commendably "dead" and panel resonances are well muted.

So how do they sound on music. To some ears, on orchestral music, the treble may sound a little bright but extended listening indicates that it is more a matter of clarity of reproduction than a matter of a bright response. Stringed instruments are very well produced and the stereo imaging from a pair of these speakers is very sharp (hence the name "Image"?)

On normal instrumental music it cannot be said that the bass response of the Image 4s seems notable. As noted above, it is quite restrained, a sign that there is little bass distortion. It is only when you play classical organ or piano pieces that it really shows its stuff.

The dynamics of a concert grand piano are rarely reproduced by any hifi system regardless of its cost. Consider that the lowest note on a piano is A, four octaves below A 440Hz. That means its fundamental frequency is 27.5Hz. Consider also that the piano has the largest dynamic range of any instrument in the orchestra and you begin to get some idea of how difficult it is to reproduce. In fact, the full bottom octave of the piano is not reproduced at all, on fundamentals, by many bookshelf speakers which have a bass cut-off at 70Hz or higher.

Hence, on paper the Image 4s should be well suited to piano works and indeed they are. As one who is exposed to a great deal of piano music (from a Yamaha U1A) played by my daughters, I can state that I have never heard a loudspeaker give a more realistic rendition of the piano. The growl of those bass strings together with the big sounding board is really there. You can hear the damper action cl and even the squeak of pedals o pianist's stool on some tracks – impressive.

On drums, whether played i orchestra or a jazz combo, the In 4s are startling – you will not deeper bass unless it is from the thing. These speakers are what s hifi enthusiasts call "fast". Thei tack on transients is what makes t reproduction of piano, drums percussion instruments so good.

It almost goes without saying t the rendition of classical organ pie is a delight to hear, and feel. Aga they can seem quite subdued in bass when compared with other la loudspeakers but when they "spea they are clearly heard. For a speak with such an extended bass, you mig expect it to be a little "chesty" male voice but it is quite natural. N problems on that score at all.

Efficiency of the Image 4s is abo average at 90dB/1W/1m and to get t best out of them you need an ampl fier capable of at least 100 watts p channel into 4-ohm loads. The manu facturer specifies their power handlin at up to 180 watts but I would g further and state that they should com fortably handle the output of a 200 t 250 watt per channel amplifier o normal program material.

Conclusion

By any normal standard, this must be rated as a rave review. In my listening room which has cement rendered walls, slate over a concrete floor with rugs and plenty of bookshelves to give a room sound which is about right (not too bright), these speakers gave an exceptional account of themselves – I have not heard better, even from speakers costing many times more. There, I've really gone and said it.

But the Dynaudio Image 4s are not cheap and are well out of the range of most enthusiasts. Their recommended retail price is $2490 a pair and they have a 5-year warranty. However, if you can afford them they will give far more satisfaction than other speakers costing many times the price. If you cannot afford them, have a listen to the lower priced units in the range which start from $690 a pair.

For further information, contact Scan Audio Pty Ltd, 52 Crown St, Richmond, Vic 3121. Phone (03) 429 2199. **SC**

MAILBAG

SILICON CHIP,
PO Box 139,
Collaroy Beach 2097.

Home security with a CCTV system

Your article on the Alarm-Triggered Security Camera in the March 1993 issue of SILICON CHIP prompts me to write about a Neighbourhood Watch type idea that floats to the top of the mind from time to time.

As you are aware, break and enters are one of the great scourges of modern living. My idea is that a household should use the ubiquitous VCR, hooked up to simple video cameras as a recording surveillance system, so that would-be criminals can be identified as they check out what is easy to get into around the suburb.

I envisage a system where there are hidden cameras positioned to see who comes to the front and back doors and whatever other points you want to cover. The cameras record to the VCR and, to make a tape last a weekend or longer, only take a shot every few seconds or whenever movement is detected.

Systems such as I describe are commercially available but for prices of several thousand dollars. I would assume that nowadays all the necessary parts for a surveillance recording system are available quite cheaply. It just (just?) requires the know-how of SILICON CHIP magazine to identify the components and work out how to put them together.

I know someone is going to say "You aren't going to help the police much when they steal the VCR". That is quite right but the idea is based on the known facts (check with your local Neighbourhood Watch) that most break and enters are crimes of opportunity performed by lazy people who are not terribly clever.

These people do not break into every dwelling they approach; instead, they go around the suburb looking for an easy mark.

Someone is also going to say "Isn't it a bit of a long shot installing one of these systems and hoping to film criminals?" I don't think so. With the number of break and enters that there are, especially in the inner suburbs, it is quite probable your dwelling is occasionally examined as a potential target.

So there is my idea. If the device can be made for a low enough price, and enough of them are installed out in the suburbs, the house breakers will soon realise they are being caught a lot more often and give housebreaking away as being too risky, enabling us to live in peace once again.

Robert Ward,
Yeronga, Qld.

Comments on computer monitor reliability

I have a comment regarding the letter from R. Pankiv of Sheffield, Tasmania, on page 11 of the March 1993 issue, requesting more information on appliance servicing. I suggest that he contact Jim Lawler with a view to becoming a member of the Electronic Technicians Institute, Tasmania Division of which Jim is the Secretary. Jim Lawler's address is 16 Adina St, Geilston Bay, 7015.

I feel that this would best satisfy Mr Pankiv's need for servicing information of all sorts. This does, of course, assume that Mr Pankiv is a qualified technician.

On the subject of the Publisher's Letter in the March 1993 issue, I do agree that the computer monitor is one of the least reliable components of a computer system; second would be the more unstable or poorer quality motherboards. I would also agree that the majority of faults occur in the power supply and deflection circuit. What I don't agree with is your assessment of the computer monitor service industry. In your letter you outline two types of repair agent, large companies who charge a fortune for either board replacement or component level repair.

What about us, the third type of company that you chose not to outline in your article: those businesses that work tirelessly in an effort not to write the unit off so that the customer does not need to spend extra money on a new monitor; those businesses who offer fixed price servicing of computer monitors with prices that are at least half those mentioned in your article.

You guessed it, I'm blowing my own horn and those like me who offer a service of monitor repairs for $100.00, or $150.00 for some monitors requiring expensive parts. For customer oriented small businesses like mine, $200.00 for a 5-cent resistor is definitely not on.

Eli Montebello, MTETIA,
EEM Electronics, Epping, Vic.

More on computer monitor reliability

I read with interest your editorial in the March issue about the lack of reliability of computer monitors. This problem is becoming particularly noticeable with the increase in the reliability of other computer components.

Many modem manufacturers are now offering 2-year warranties, with some offering up to five years (Telebit, ZyXel, AT&T). Hard drive manufacturers also now routinely offer 2-year warranties, often with a small extra fee for a 5-year warranty (similar to the extended warranties that were offered on colour TVs not so long ago). Traditionally, the lifetime for a hard drive is 2-3 years, so we're going to have to re-evaluate our expectations.

It is becoming rare to see a computer come back for servicing within two years of its initial sale. Often they will run for 6-8 years without any problems at all – except for the monitors! In fact, most computers come back for hardware upgrades.

On the subject of board level repairs, monitor manufacturers aren't the only ones with this policy – Apple does this with the Macintosh, with a fixed service fee for a Mac IIcx.

About the only way I know of reliably getting manuals as a consumer is to make the supply of a service manual a condition of sale. However, at least one university I know of with the same policy has consistent problems with it not being enforced, with attendant hassles for the technicians when the equipment inevitably fails.

A. Brown,
Palmerston North, NZ.

CIRCUIT NOTEBOOK

Interesting circuit ideas which we have checked but not built and tested. Contributions from readers are welcome and will be paid for at standard rates.

Interface for the LCD panel meter

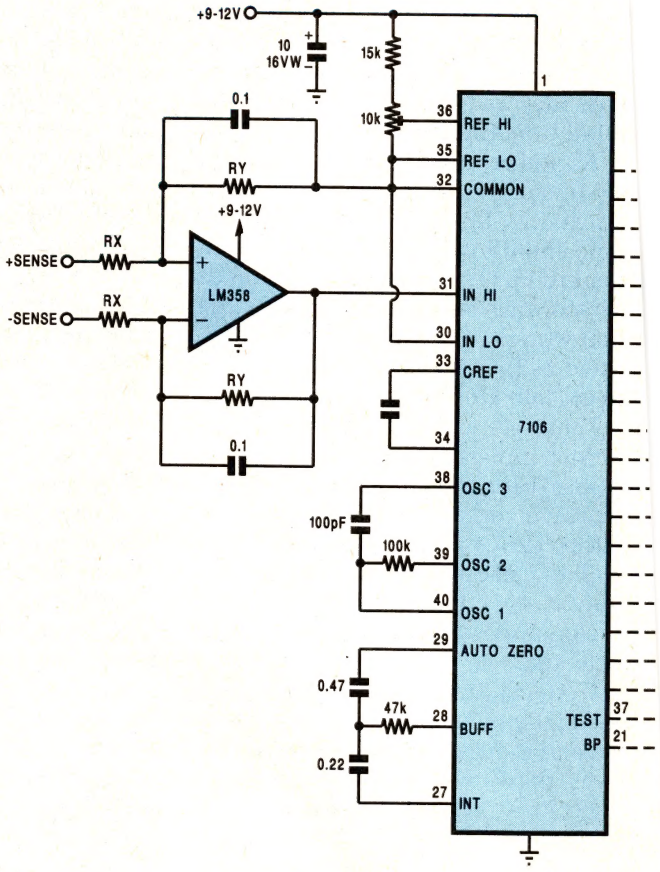
While the LCD panel meter published in the September 1992 issue has proved popular, a problem arises if you want to power it from the same circuit you are monitoring.

To operate correctly, the 7106's differential inputs must range between about 1V above ground and 0.5V below pin 1, the meter's positive supply. This is a problem when you power the meter from the same supply that you are monitoring, because the IN LO pin then needs to sit at 0V.

This circuit gets around this problem by using an LM358 op amp to drive the INHI input. The non-inverting input of the op amp is biased from the REFLO pin, which is tied to INLO and COMMON as in the original circuit. The differential inputs of the op amp can then be pulled high or low and provided the gain is such that the meter does not overrange, the inputs of the 7106 will always be within the correct voltage range.

The gain for the circuit is set so that the largest voltage to be measured will give an output of 2V above the bias voltage. For example, a 0-20V range will need a 10:1 divider or a gain of 0.1. Setting Rx to 100kΩ and Ry to 10kΩ will give this gain. Similarly, for a 0-200V range, a 100:1 ratio is achieved if Rx = 100kΩ and Ry = 1kΩ.

Current measurements are made by simply connecting the differential inputs across a sensing resistor and setting the gain accordingly. To measure up to 2A, use a sensing resistor of 0.1Ω. This will have 200mV across it when 2A flows through it. Selecting a gain of 10 will then give the correct reading on the liquid crystal display.



Phil Angilley, Brookvale, NSW. ($20)

Seven day hose controller

This timer was designed to meet the watering restrictions current in Brisbane. These allow watering times in 4-hour blocks on three days a week, with no hoses allowed from 10am-2pm.

Since the watering times are based on 4-hourly blocks, the timing circuit based on IC1-IC4 produces a high pulse at pins 6, 9 & 10 of IC4 every four hours. IC1, a 14-bit binary counter, is cascaded with IC2, a 12-bit binary counter. The clock signal for IC1 is obtained from the power transformer's secondary via a resistive voltage divider clamped by ZD1, a 10V zener diode.

To provide the required 4-hour long pulses, IC3 (a triple 3-input NAND gate) is combined with IC4 (a 4025 triple 3-input NOR gate) to provide a 9-input AND gate function.

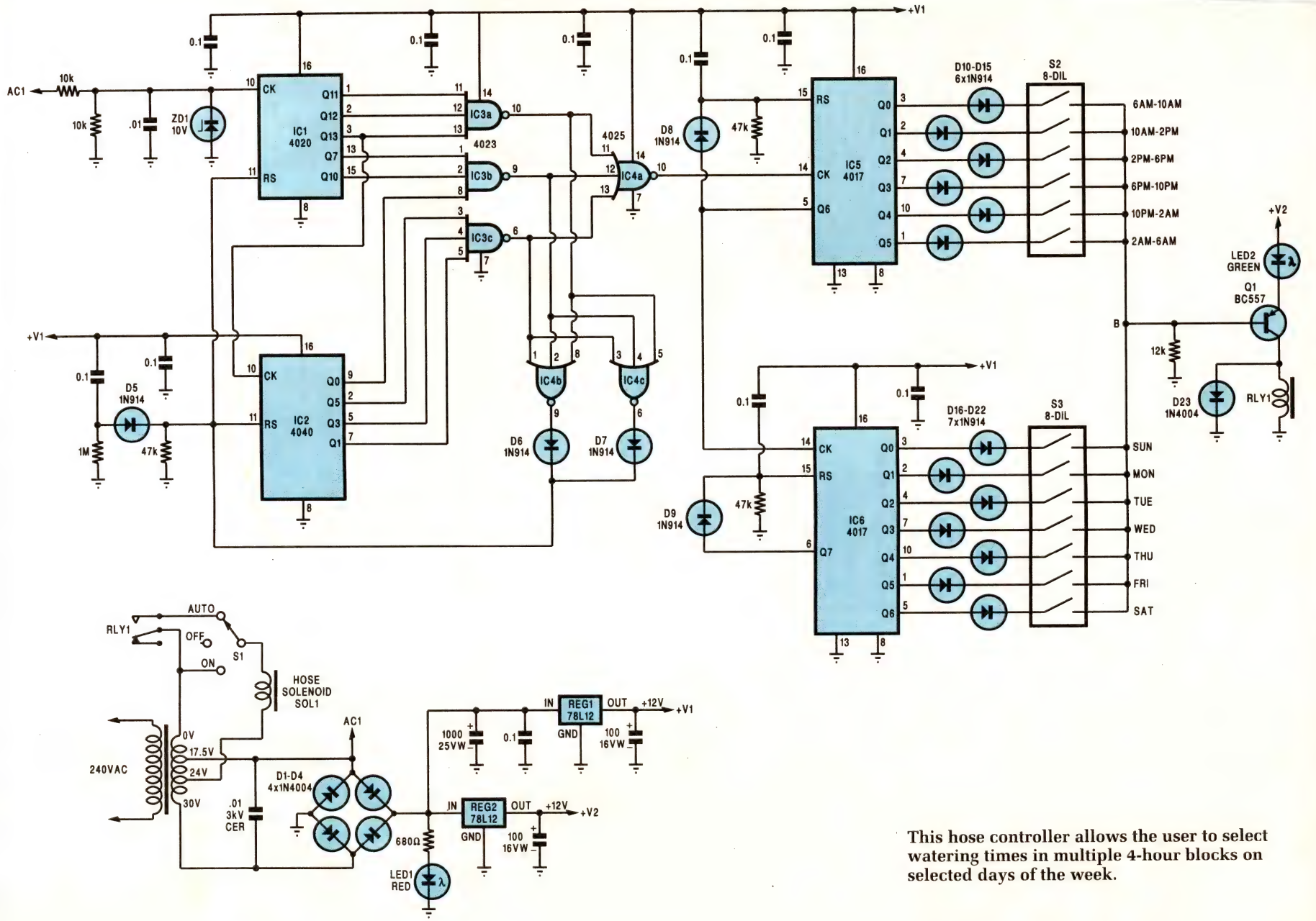
The 4-hour pulse output from pin 10 of IC4 is coupled to the clock input of IC5, a 4017 decade counter and 1-of-10 decoder. The six used outputs of IC5 each go high in turn for four hours, corresponding to a 24-hour period in total. The 7th output, Q6, goes high after 24 hours and is used to clock IC6, a 4017 used as a 7-day counter. Q6 of IC5 also provides the reset to pin 15 via diode D8.

Each of IC6's seven used outputs goes high for one day. The 8th output of IC6, Q7, provides the reset to pin 15 via diode D9.

The selected 4-hour output from IC5 and the selected day output from IC6 are ORed via the respective diodes and fed to transistor Q1 which drives relay RLY1, a 12V subminiature type from Dick Smith Electronics (Cat. S-7112). This applies 24VAC power to the hose solenoid from the power transformer. The .01µF 3kV ceramic capacitor across the bridge rectifier (D1-D4) suppresses turn-off transients from the solenoid which would otherwise cause premature resetting of IC1 and IC2.

The water solenoid used in the prototype was obtained from Goyen Controls, part number ST2-6/1361, and cost $32.70.

John Holliday, Nathan, Qld. ($50)



This hose controller allows the user to select watering times in multiple 4-hour blocks on selected days of the week.

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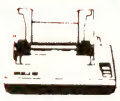

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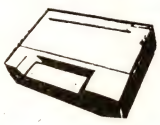
C22070..... $399



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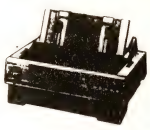

LQ-1070 136 Col, 24 Pin Dot Matrix, 252 Cps Draft., 84 Cps NLQ, Scalable Fonts, 8 to 32 point, 11 LQ Fonts, 360 x 360 DPI, Top, Rear, Bottom, and Front Paper Feedpaths, Convertable Push/Pull Tractor
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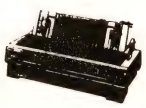

LQ-570 80 Col, 24 Pin Dot Matrix, 252 Cps Draft, 84 Cps, NLQ Scalable Fonts 8 to 32 points, 11 LQ Fonts 360 x 360 DPI, Top, Rear, Bottom and Front paper feed paths, Convertable Push/Pull Tractor.
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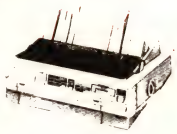

LX-100 80 Col, 9 pin Dot Matrix, 240cps Draft, 48 cps NLQ, 3 fonts, 50 sheet paper cassette Standard Push Tractor with SmartPark.
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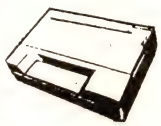

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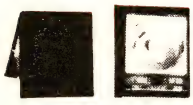

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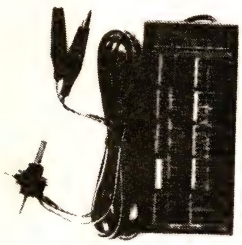

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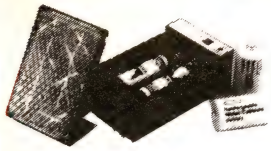

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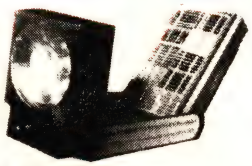

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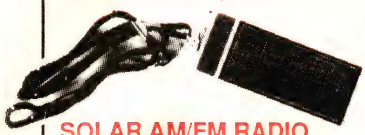

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• Features a convenient and contempory design with pendent thread for carrying anywhere.
Great for the beach, on walks, on the train or bus, even in bed! (Yes it can be used at night!) And if the sun doesn't shine for months you can still enjoy the radio. An ordinary light bulb will provide the energy you need.
Can also be operated by DC charging by connecting a 3.5mm plug of an adaptor to the DC-IN 3V jack of the radio.

Z19067. .....$29.95

SOLAR ANTI MOSQUITO GUARD

This ultra sonic high frequency repels most biting mosquito's away to let you enjoy the great outdoors.
It's the safe way to keep these pests out of your life. No smell and causes no harm to human beings, pets or animals. Rechargeable for night time use. Graet for camping, hunting, fishing, farming, sleeping, working at night etc.

Z19072.....$7.95

SOLAR PLANT TURNER

Do you have a collection of any type? Dolls, toys, pottery, jewellery, and you want to give your display a bit of animation and intrest. Then this solar plant turner is just the thing. A rotating base powered by the sun!
No more lopsided plants that lean towards the sun when you purchase the new Solar Powered Plant Turner your plants will grow like never before! This multipurpose product can also be used as eye-catching shop display, continues rotations of your product that won't send your electricity bills flying!

Z19070...WAS ~~$24.95~~

SALE PRICE.....$16.95

WATER PLANT SOIL TESTER

Now when you talk to your plants they will sing back to you. This tester is designed to tell you when your plants have had enough water by playing music, what a great gift idea now everyone will have green fingers!

Z19074.....$5.95

SOLAR PANEL 3, 6, 9 VOLT

Simple and easy to use , this solar panel converts the sun's energy to electrical power supply of 3, 4.5, 6, and 9 volts for different electrical appliances. An ideal and convenient power supply for powering to small calculators, radios, battery operated toys....etc. This product also doubles as a battery charger for "AA" size rechargeable batteries.

Z19013.....$24.95

SOLAR AM/FM RADIO KEYCHAIN

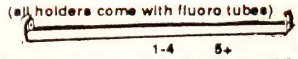
Pocketsize AM/FM radio with keychain and clip for easy listening anywhere anytime.Wherever your keys go so does your solar radio. Free entertainment to go in your pocket, and not a flat battery in sight!

Z19068.....WAS ~~$29.95~~

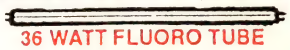
SALE PRICE.....$24.95

WE CARRY A LARGE RANGE OF ELECTRICAL PRODUCTS
FLOURO BATTEN HOLDERS HUGE RANGE

(all holders come with fluoro tubes)



	1-4	5+	
S18000...1 X 18W	$18.98	$17.98	LPF
S18010...1 X 36W	$22.98	$21.95	LPF
S18020...1 X 36W	$22.95	$21.95	HPF
S18030...2 X 36W	$37.95	$35.00	LPF
S18040...2 X 36W	$37.95	$35.00	HPF



36 WATT FLUORO TUBE

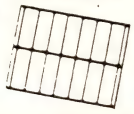
1-9.... 10+...
$4.95 $4.50

(WE ARE CHEAPER THAN THE HARDWARE STORES AND BIG NAME STORES)

NEW COMPUTER LABELS

You asked for labels for your laser now there in!

Label size 25.4mm x 98mm
20 labels per sheet 50 sheets per packet (on a A4 sheet)
C20106.....$39.95
for 1000 labels



Label size 38.1mm x 98mm 14 label per sheet 50 sheets per packet (on a A4 sheet)
C20108.....$39.95
for 700 labels

Label size 37mm x 105mm
16 labels per sheet 50 sheets per packet (on a A4 sheet)
C20110..... $37.95
for 800 labels

LED BAR GRAPHS

BACK IN STOCK
An end stackable L.E.D. bar a S.I.L pin package. Suited for solid state meter movements and level indicators.
(10 leds in a row)

	1-9	10-99
Z10180.....	$3.95	$3.50

DON'T PAY $4.95 AT OUR OPPOSITION

FOR THE COMPUTER SERVICE MAN

THESE QUITE OFTEN BLOW UP IN SVGA COLOUR MONITORS

LM1203 VGA INPUT DRIVER

	1-9	10+
U10440.....	$5.95	$4.95

UNIX HEAT SINK COMPOUND

Heatsink compound is applied to the base and mounting studs of transistors and diodes. It maintains a positive heatsink seal thet improves heat transfer from the device to the heatsink, thus increasing overall efficiency

(SAVE $10 A TUBE THIS MONTH)
NORMALLY ~~$29.95~~ weight..150g
H11810....SUPA SPECIAL $19.95

ROD IRVING ELECTRONICS

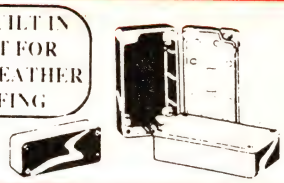
MAILORDER HOTLINE: 008 33 5757

ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS

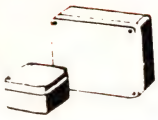
ROD IRVING ELECTRONICS

WHO HAS DIE CAST CASES? WE DO!

WITH BUILT IN GASKET FOR TOTAL WEATHER PROOFING



GREAT VALUE! COMES WITH BUILT IN RUBBER GASKET AND WEATHER PROOFING



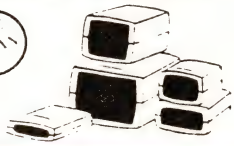
NEW DIECAST BOXES

		1-9	10+
H30000	90x36x30mm	$6.75	$5.95
H30010	64x58x35mm	$6.95	$6.25
H30020	115x65x30mm	$10.95	$9.50
H30030	115x65x55mm	$12.95	$11.50
H30040	115x90x55mm	$15.95	$14.50
H30050	148x108x75mm	$27.50	$24.50
H30060	171x121x55mm	$27.95	$24.95
H30070	222x146x55mm	$29.95	$27.95

NEW SEALED POLYCARBONATE ENCLOSURES

		1-9	10+
H30200	64x58x35mm	$4.95	$4.50
H30210	115x65x40mm	$6.95	$5.95
H30220	115x65x55mm	$8.95	$7.95
H30230	115x90x55mm	$11.95	$9.95
H30240	117x121x55mm	$19.95	$17.95
H30250	222x146x55mm	$24.95	$22.95

ONLY A 1/4 OF THE PRICE OF EUROPEAN ONES



COME IN & HAVE A LOOK!

NEW INSTRUMENT CASES

		1-9	10+
H30300	90x15x16mm	$4.95	$4.50
H30305	90x50x24mm	$5.95	$4.95
H30310	90x50x32mm	$6.50	$5.50
H30315	120x60x30mm	$6.95	$5.95
H30320	120x60x40mm	$7.50	$6.25
H30325	120x60x50mm	$7.95	$6.50
H30330	150x80x30mm	$8.95	$7.50
H30335	150x80x45mm	$9.95	$8.50
H30340	150x80x60mm	$11.95	$9.95
H30345	190x100x40mm	$12.95	$10.95
H30350	190x100x60mm	$14.95	$12.95
H30355	190x100x80mm	$16.95	$14.95

NEW WATERPROOF CLEAR TOP POLYCARBONATE INSTRUMENT BOXES

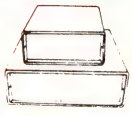
		1-9	10+
H30100	64x58x35mm	$8.95	$7.95
H30110	115x65x40mm	$11.95	$9.95
H30120	115x65x55mm	$12.95	$10.95
H30130	115x90x55mm	$14.95	$12.95
H30140	171x121x55mm	$20.95	$18.95
H30150	222x146x55mm	$24.95	$21.95

WHO CATERS FOR ALL YOUR ELECTRONIC NEEDS?....WE DO MATE!

PLASTIC BOXES

Plastic boxes with plastic lids.
Comes with 4 screws
Black in colour.
H10128 83 x 54 x 28mm..... **$1.95**
H10126 130 x 68 x 41mm....**$2.50**
H10122 150 x 90 x 50mm....**$3.95**
H10124 195 x 113 x 60mm..**$4.95**

NEW CASES



Beige plastic moulded cases with aluminium end panels

160mm (W) x 55mm (H) x 170mm (D). H10204.....**$22. 95**
110mm (W) x 46mm (H) x 146mm (D). H10202.....**$18. 95**

EPROM SPECIALS

	1-9	10-25	25+
27C64-20	$4.50	$3.90	$3.50
27C256-20	$5.00	$5.00	$4.50
27C512-15	$6.00	$5.50	$5.00

EPROM ERASER With Timer

Sure it erases your EPROM's quickley and safely and will erase up to 9 x 42 pin devices in about 40 minutes. (less for less chips). But with this one you don't have to waste your time standing around waiting for them. The EPROM has a timer which allows you to "set and forget". By using the timer function it not only saves you money by reusing your EPROM's but you also save presious time doing other jobs while the eraser is working. And you'll never have to worry about turning it off and "cooking" your EPROM's. Choose from a wide range of different settings from 15 minutes to 40 minutesdepending on the intensity of the UV source.
*The chip door has a conductive foam pad.
*High intensity at the chips surface ensures EPROM's are thoroughly erased.
*Engineered to prevent UV exposure.

SAVE $20 **$149.00**

BNC CONNECTORS

BNC JACK TO BNC PLUG "L" TYPE.
Great for Network cards at the back of computers.
P10526.....**$6.95**

BNC FEMALE LINNE JACK TO SUIT RG5
P10535.....**$2.95**

MIC 3 PIN LINE SOCKET
P10280.....**$6.95**

BNC "T" ADAPTOR
P10517.....**$6.95**

TOOLS & TECHNICAL

COMPONMENT RETRIEVAL KIT

Supplied with two fully insulated tweezers and long flexible finger with a magnet on the end . Allows smi components and to be picked up or manipulated in s narrow hard-to-get-at places

T12084.....$10.

PLASTIC VICE WITH SUCTION BASI

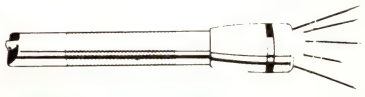
Medium sized vice ideal for holding parts and components during soldering or glueing.
•Stong suction base adheres to any non porous surfac
•Lever secures or releases suction
•Plastic jaws with rubber pads
•Jaws open out to 50mm
•Size:Approx 110 x90 x80

T12459.....$6.95

HANDSFREE MAGNIFYING GLASS

FOLDING MAGNIFYING GLASS
Free standing magnifing glass.
•Allows hands free operation
•Large 115mm (4.5") Lens
•Folds completely flat for storage

T10020.....$13.95



ALUMINIUM TORCHES

Battery size:1xAA.....Not Supplied
A15066 ..... $ 9.95
Battery size:2xAA.....Not Supplied
A15068.....$10.95
Battery size:3xAA.....Not Supplied
A15067.....$11.95

Machined "Aircraft Alluminium" flashlights.
•Lens case unscrews and doubles as a free standing torch base.
•Adjustable lens varies the beam from a spotlight to flood light.
•Rubber water resistant "O" rings.
•Replacement globe stored in base of the torch.

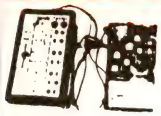
RECHARGED KEY RING TORCH

Miniature handheld torch designed specifically for the car. It comes with a 'quick-click' removable keyring which allows removal of your car keys while recharging. The torch utilizes a nickel cadmium battery 5 which can be recharged serveral hundred times. this can be done at any time, even while driving as the torch body itself is shaped to fit directly into the cigarette lighter socket. Ideal for use with cars, trucks, boats and other 12 volt negative earth vehicles. The unit is made of a sturdy black plastic, comes complete with a keyring and is push button operated.

A15070.....$11.95

BOX HILL STORE
NOW OPEN
1031 MAROONDAH HWY
(opposite BoxHill town hall)
Ph: (03) 899 6033 FAX: (03) 899 0156

KITS ARE BACK! Slowly but surely we are introducing our new kit range.



RANSISTOR TESTER

u ever desoldered a suspect
or only to find that it checks OK?
shooting exercises are often
d by this type of false alarm, but
f them could beavoided with an
uit" component tester, such as the
dy Tester. (EA Sept. '83) 83TT8
80.....$22.95

BALANCED INPUT DIFFERENTIAL PREAMP

ersitile little preamp has a host of
cations in the audio-and-beyond
, not the least of which would be as
nced mic preamp.
61 Dec'82 ETI)
070.....$19.95

COLITE

kit makes your
s do amazing
gs. With 4 light channels controlled
separate audio channels. Eg.
ward, reverse, auto reversing chaser
erns, alternating light patterns,
istable rate for light patterns,
ultaneous strobe on all four channels.
s many more features! (Sil Chip July
8)
0130.....$155.00

GENERAL PURPOSE PREAMPLIFIER

A general purpose stereo preamplifier using a single LM382 IC which can be tailored for use with magnetic pickups, tape recorders, and microphones by changing a few components
(ETI445) (ETI July '76)
K10055.....$14.95

GENERAL PURPOSE AMPLIFIER CLASS B.

One of the handiest "tools" for the electronics experimenter is a genuine purpose audio amp. This module will work from a wide range of supply voltages, has very good sensitivity, is robust, reliable and easy to build too!
(ETI 453) ETI April '80)
K10065.....$14.95

PLAYMASTER 300W AMPLIFIER

300 WATTS INTO 4 ohms
This module will deliver up to 200 watts into an 8ohm load. Comprehensive protection is included and a printed circuit board brings it all together in a rugged easy-to-build module. It can be built in either fully- complementary or quasi-complementary versions, so output transistor shortages should be no problem at all.
(80pa6) (EA July '80)
K10085.....$109.00

50W AMPLIFIER MODULE (ETI 480)

Use these high performing modules in band amps, P.A even HiFi's.
Very simple to build and work because everything's on the one pcb.
Heatsink optional extra
K10040.....$27.95

100 W AMPLIFER MODULE (ETI 480)

Similar to the above module but this one is 100 watts of power.
Heatsink optional extra
K10045.....$32.95

MIKE PRE AMP

High quality transformers for matching balanced microphones into unbalanced inputs are quite expensive. This simple preamplifier will accept balance inputs directly.
(ETI May '77, ETI 449)
K10060.....$11.95

MORE KITS COMMING SOON!

SOLAR GENERATOR

The ETI-569 Solar charger is designed to charge any standard 12 V lead acid car battery in any area where mains power is unavailable. It is ideal for remote data acquisition stations, caravans and boats. Of coarse there are other solcar chargers around, but these are extremely expensive. With the ETI-569 the emphasis is on simplicity and cheapness.
K10005.....$13.95

ELECTRIC FENCE KIT

Main to battery powered, this electric fence controller is both inexpensive and versitile. Based on an automotive ignition coil, it sould prove an adequate deterrent to all manner of livestock. Additionally it's operation conforms to the relevant clauses of Australian Standard 3129. (EA Sept. '82) 82ef9
K10110.....$23.95

ELECTRIC FENCE CONTROLLER

Restore the discipline to the farm or allotment with this new electric fence controller. It features higher output power and lower current drain than the previous design.
(EA Dec. '85, 85ef11)
K10115.....$61.95

POWER SUPPLIES

NEW LOWER PRICES FOR POWER SUPPLIES!

T POWER SUPPLY 150W....$139.00
JLL TOWER
20W POWER SUPPLY.....$149.00
INI TOWER
00W POWER SUPPLY.....$89.00
ABY AT
00W POWER SUPPLY.....$89.00
SLIMLINE BABY AT
00W POWER SUPPLY.....$89.00

SUPA SPECIAL!

57MM SPEAKERS (2 1/4")

1-9	10+	100+
$1.00	85¢	75¢

(Available all stores)

FERRIC CHLORIDE

25%more from RIE for the same price as from our opposition.

H10810	250gm.....	$4.95
H10812	500gm.....	$7.95
H10814	1Kg	$11.95

SAVE WITH THESE GREAT VALUE PACKS!

FUSE PACKS
3AG PACK OF 40 ($10 Value)
Contains: 4 x 500mA, 8 x 1A, 6 x 1.5A, 2 x 2A, 6 x 3A, 4 x 5A, 2 x 7.5A, 4 x 10A
S15992.....$8.95

M205 Pack of 40 ($10 Value)
Contains : 5 x 500mA, 10 x 1A, 10 x 2A, 5 x 3A, 5 x 5A, 5 x 10A
S15994.....$8.95

MIXED IC SOCKETS
100 units ($37.00 value)
Contains: 15 x 8 pin, 20 x 14 pin, 10 x 16 pin, 10 x 18 pin, 5 x 20 pin, 10 x 22 pin, 5 x 24 pin, 5 x 28 pin, 10 x 40 pin,
P10546.....$24.95

DIODE PACKS (100 per pack)
1N4002 (1A 200V Rectifier)
Z10103.....$4.95
1N4004 (1A 400V Rectifier)
Z10106.....$5.95
1N4007 (1A 1000V Rectifier)
Z10112.....$6.95
1N914 / 1N4148
Z10135.....$3.95
1N5404 (amp 400V)
Z10114.....$12.95

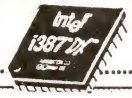
LED MIXED PACK
(Red only 5mm) Approx 100 pieces
Z10138.....$11.95

LED MIXED PACK
(MIXED COLOURS)
Approx. 100 pieces, 5mm size,
Contains: 50 Red, 25 Yellow, 25 Green
Z10136.....$14.95

MIXED SCREW PACK
Approx 100 pieces. This pack is a must for the electronics handy person and computer service person. Contains screws for conputer cases Disk Drives etc.
H10960.....$3.95

MIXED POLYESTOR PACK
(In IEC Package)
Approx. 50 pieces
R15120.....$9.95

WOW 80387DX MATHS COPROCESSOR SMARTEN UP YOUR 386



only.....$249

NEW CHEAPER SOLDER PRICES

25% MORE PRODUCT THAN OUR OPPOSITIONS FOR THE SAME PRICE

60/40Resin Cored ABSOLUTE TOP QUALITY

ROD IRVING ELECTRONICS

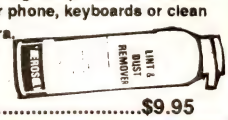
25% MORE *

SOLDER ROLLS

T31000	.71mm 250gm	$8.95
T31002	.71mm 500gm	$15.95
*T31010	.91mm 250gm	$7.95
T31012	.91mm 500gm	$14.95
T31020	1.6mm 250gm	$7.50
T31022	1.6mm 250gm	$13.95
T31030	.71mm 1metre	$1.50
T31032	.91mm 1metre	$1.50
T31034	1.6mm 1metre	$1.50

LINT AND DUST REMOVER

Blow away the dust and grime out of those hard to get at places like buttons on your car phone, keyboards or clean your camera.



N11036.....$9.95

BOX HILL STORE NOW OPEN

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(opposite Boxhill town hall)
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BNC PLUGS AND SOCKET

BNC MALE PLUG

	1-9	10-99	100+
P10514	$2.50	$2.25	$1.50

BNC PANEL SOCKET

	1-9	10+	100+
P10516	$2.50	$2.25	$1.50

BNC CRIMP PLUG

	1-9	10-99	100+
P10530	$3.95	$3.75	$3.00

BNC SOLDERLESS TWIST ON PLUG

	1-9	10-99	100+
P10531	$3.50	$3.25	$3.00

CANNON PLUGS AND SOCKETS

CANON TYPE 3 PIN LINE MALE

	1-9	10+	100+
P10960	$4.95	$4.75	$ 4.50

CANON TYPE 3 PIN CHASSIS MALE

	1-9	10-99	100+
P10962	$3.50	$2.95	$2.50

CANNON TYPE 3 PIN LINE FEMALE

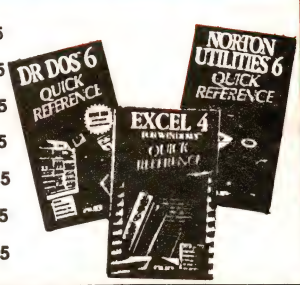
	1-9	10-99	100+
P10964	$3.95	$3.50	$2.90

CANNON TYPE 3 PIN CHASSIS FEMALE

	1-9	10-99	100+
P10966	$4.95	$4.50	$3.50

QUICK REFERENCE BOOKS

PC TOOLS 7.....	B21302	$19.95
NORTON UTILITIES 6.....	B21304	$19.95
EXCEL 4 for WINDOWS.....	B23004	$19.95
Dr DOS 6.....	B23002	$19.95
MS-DOS 5.....	B21267	$19.95
RELEASE 2.4 1.2.3.....	B21264	$19.95
WORDPERFECT 5.1.....	B21268	$19.95



ROD IRVING ELECTRONICS MAILORDER HOTLINE: 008 33 5757

ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS

ROD IRVING ELECTRONICS

"NEW" SOUND BLASTER 16 ASP

Get a Speech Recognition Software FREE!

Sound blaster with 16 ASP (Advanced Signal Processing) brings you the latest audio technology with professional CD-quality found only in expensive DAT machines. With outstanding features like ASP and the numerous bundled professional software, Sound blaster 16 delivers powerful audio experiences beyond your imagination.

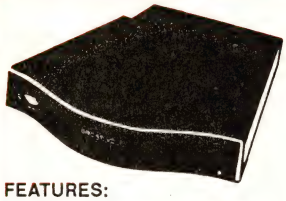
FEATURES INCLUDE:

• True 16-bit stereo sound • 4-operator, 20 voice stereo FM synthesis • Improved stereo digital mixer • Wave Blaster Upgrade Option • CD-ROM interface • Software Controls.

Comes with a full library of professional high value software to maximize your Sound Blaster 16. now

X17065. ~~$479~~ $429

MIDI BLASTER



The MIDI BLASTER offers a wide range of sampled General MIDI sounds in a compact unit. It may be used a powerful unit for sequencing, an extra sound source for musicians and multimedia enthusiasts and also as an extension of the Sound Blaster Pro.

FEATURES:

Polyphony: 20(sounds + drums)
Channels: 16 (MIDI channels 1 to 9 and 11 to 16: sounds) (MIDI channel 10: drums)
Presets: 128 (Sounds), 33 (effects), 55 (drums)
Synthesis: Mixed PCM/FM
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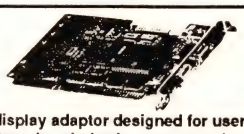

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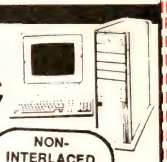

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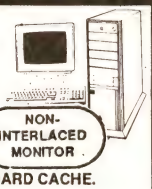

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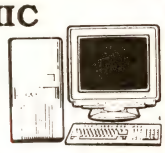

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TALK TO YOUR PC with the Microsoft Windows Sound System

The Microsoft Windows Sound System mark a breakthrough. It can record CD qualit sound, add sound to business presentations and control many Windows applications

By DARREN YATES

IMAGINE BEING able to throw away your mouse and keyboard and operate Windows and any Windows applications by just speaking the commands into a microphone. Sounds pretty good, doesn't it?

This ideal is a little way off yet but Microsoft has just released the first low-cost practical sound interface system designed for serious applications.

But it's much more than just a digital audio recorder or a voice command translator. It's a complete audio system designed to enhance and support business reports and displays.

So when we were offered the chance to take a look at Microsoft's latest package, we jumped at it! As we see it, audio command input or voice recognition will be a significant step forward in computer evolution.

The opportunities and applications are endless – from automatic teller machines, to desktop publishing, to medical work, to industrial control. It will also be a great step forward for the disabled, enabling them to take part in careers that would otherwise be a whole lot more difficult.

And it will make computers more accessible to the general public, reducing some of the "fear" that prevents many from using them. Keyboards and buttons will be replaced by just a microphone, making computers easy to use.

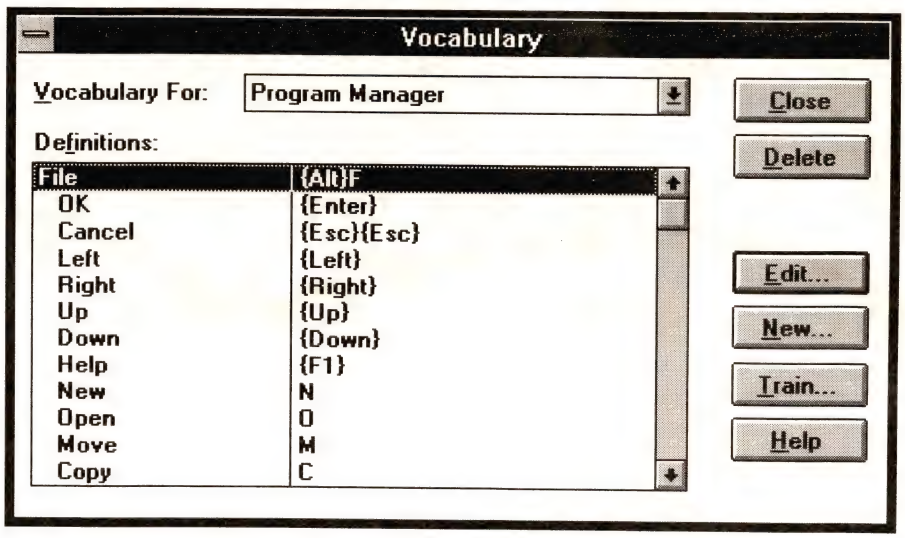
The Microsoft Windows Sound System comes with a sound card (with an Analog Devices' DSP chip on board), a pair of headphones, a microphone, a set of floppy discs and a comprehensive manual.

The card is a 16-bit device so you'll need a spare 16-bit slot. There are two RCA line out sockets and several stereo 3.5mm sockets which serve as audio inputs and outputs. If you don't like wearing headphones, you can connect a couple of small un-powered or powered mini speakers to the headphone socket.

So being calm, methodical and following the normal rules, we lunged straight for the discs and loaded the program in. However, Microsoft has apparently realised that few people bother to look at the manual at this stage. We say that because once the program has been loaded, the initial screen talks about installing the board – which isn't a bad idea!

Installing the program

Installation of the program is as simple as loading the first disc into



The Vocabulary utility lists the voice commands used in a particular application, in this case for Program Manager. The buttons down the righthand side allow new words to be entered & edited as required.

drive and running the setup pro- ı under Windows. The Windows nd System program then takes :. It even explains the options when figuring the board, so that it doesn't ırfere with other external devices h as hard drives and modems, etc. Vindows creates its own program up for the Sound System software l this has eight icons – Volume ntrol, Recording Control, Sound ıder, Music Box, Windows Sound stem Setup, Quick Recorder, Voice ıot and Guided Tour. And, of course, ere's a comprehensive help menu well.

If you're not into reading manuals ıt want to learn about the program the shortest time possible, then the ıided tour is your best bet (but put ıe headphones on first). It takes you ırough each of the applications with imulated on-screen windows, as well s giving you examples of what to xpect through the headphones.

It doesn't take you through every ɔossible option but it will give you a ɡood idea of what to expect from the ɔrogram.

Volume Control

The Volume Control option lets you set up the volume and balance to the outputs and headphones. In the expanded view, it also sets up the audio mix from the microphone and audio inputs, as well as from a sound file already in your machine.

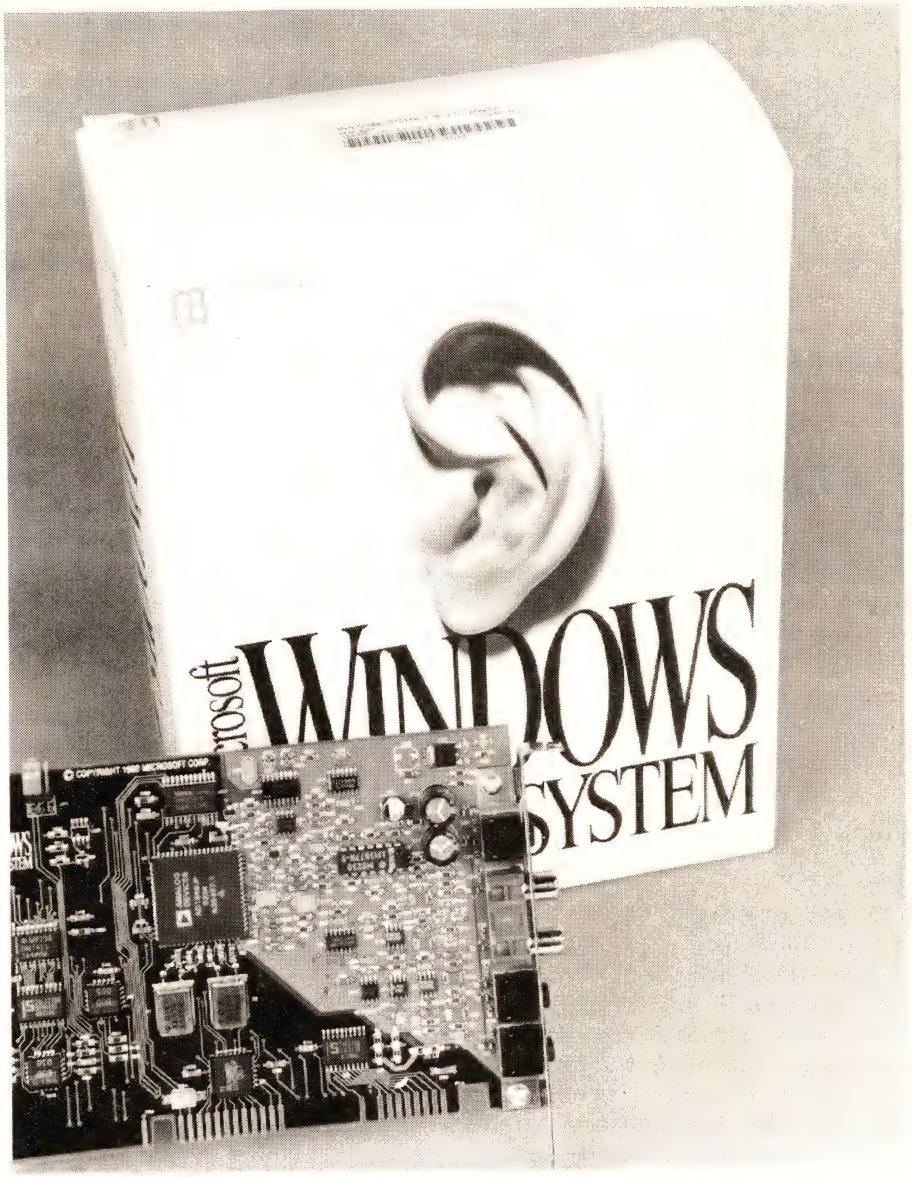
Recording Control

The recording control is slightly different in that it sets the source, either line-in or microphone input, as well as the input level and balance when you record. Note that the Sound System records in stereo with the line input but in mono with the microphone.

Sound Finder

This is the first of the major applications. Once you click onto the Sound Finder icon, the system displays a list of the sound files that come with the Windows Sound System. You can load and play any one of these files using the menu and execution keys down the righthand side of the screen.

The Windows Sound System supplies 52 sound files which include music samples, birds, elephants, clapping, industrial tools – just about everything you could imagine (except a 38-class loco climbing a steep grade).



The Windows Sound System package comes complete with a sound adapter card, a microphone, a pair of lightweight headphones, a comprehensive instruction manual & either 3½-inch or 5¼-inch floppy discs. An on-screen guided tour guides the system setup & teaches the basics to get you started.

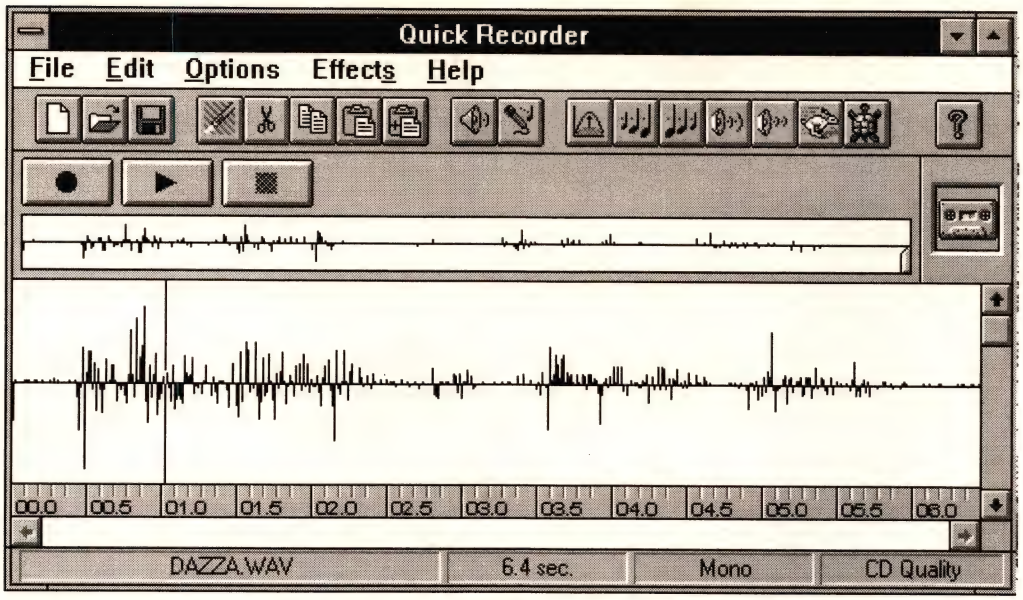
For example, you can load a file called CHIME3.WAV (all Sound System sound files have the extension .WAV). Click on the PLAY button and you'll hear the sound of wind chimes. You can stop it at any time, adjust the volume and edit the sound file.

Each sound file can also be given a special icon which describes the sound. This can be changed at any time. There is also room to give a written description of the sound file to say what it is, who recorded it or whatever.

There is also a Properties menu which shows you the sampling rate and size of a particular sound file that has been recorded.

Quick Recorder

This is where you create your own masterpieces. The Quick Recorder comes in two modes: (1) a reduced screen graphic which displays the basic record, play and stop functions, the name of the file, its duration and the current recording position (we'll talk more about this in a moment); and (2) an expanded view which gives you an editing window as well. This displays an approximated waveform of your sound file. You can think of it as an oscilloscope which can display the whole file on screen at once!



Quick Recorder displays the waveform for a selected file (in this case, Dazza.wav). It allows you to cut & paste sections of the waveform to change the word order & to add in or mix various sound effects (eg, echo, fade, speed, & base & treble filtering).

To start off, you click on the file option, and select NEW. Quick Recorder will then ask you to pick a sampling rate as well as the number of bits taken per sample.

You have three choices of sampling rate: radio (11kHz), tape (22kHz), or CD (44kHz) quality. There are also three choices for compression: compressed (4 bits per sample), normal (8 bits) and high fidelity (16 bits).

These also determine how long your recordings will be. For example, if you choose CD quality sampling at the high fidelity compression, you'll chew up 88Kb of RAM per second. And that's only for mono sound. If you want to record stereo CD quality, it becomes 176Kb per second. Over a period of 30 seconds, this works out to be well over 2.5Mb of RAM just for mono sound. The sound quality will be great but not for very long.

If you take the lowest quality options, 2.5Mb will give you about eight minutes of recording time in mono and four minutes in stereo.

Digital recording

The way Sound System records is similar to a DAT recorder. It turns the audio signal into a sequence of digital numbers which represent the instantaneous volume of the signal at a particular point in time.

These numbers can then be stored and later transformed back into the original audio image. Both the sampling rate and the number of bits per sample determine the overall sound quality, with higher numbers in both parameters producing superior recordings. Once you've selected these parameters, you then click on the RECORD button and away you go. The computer will then record the input until either you press the STOP button or you run out of memory, which ever is first.

The computer will then, after chewing over the data, display a waveform on the screen which simulates your input.

There are various effects which can now be applied to the recording and these are accessible through the EFFECTS menu. These effects include fading up and down, varying the speed in 25% increments, adding in echoes (such as auditorium, closet and canyon), filtering out treble or bass, and trimming the sound file to remove silent portions.

This last effect is useful if you wish to include as much information as possible for a given memory space.

Editing

You can also use the editing window to remove unwanted glitches in a recording or to remove whole phrases.

Sections of the sound file can be cut and pasted to another part of the file. For example, the phrase "the cat sat on the mat" can be edited to sound "on the mat the cat sat" by simply cutting the first three words from the front and pasting ther the back.

Mixing a numbe waveforms together is possible and this is d using the PASTE MIX tion from the EDIT me You can select any p tion of a waveform a mix it at any point w an existing sound file (t can be done repeatedly

By the way, we ran t Windows Sound Syste on a 25MHz 386 with co-processor and foun that if you push the sy tem to its limits (ie, reco stereo CD quality with a the memory you have), th machine runs out of spee on replay. By this, w mean that the sound i replayed in "chunks" a the program processes the next piec of audio to be sent to the output. Thi is where the Pentium® (the successo to the 486) would come in very handy

Proof Reader

If you're using Microsoft Excel or Lotus 1-2-3 from Windows, you can use the Windows Sound System to verify your numbers and text as you load them in.

You can also load in your own dictionary and Sound System will use this to check your documents. The speed at which it reads as well as the direction can all be set or customised to suit your particular application.

Voice Pilot

The Voice Pilot section was the most interesting feature of the package. It allows you to speak commands into the computer rather than having to click a mouse or punch a keyboard.

The main problem with voice recognition systems in the past has been the ability to recognise the same word being said by any number of people. Even though it is easy for you and I to distinguish the way different people say the same word, this is a much harder task for electronics to achieve.

The variation in the waveforms of two people saying the same word will be too great for the computer to recognise easily.

To get around this problem, Microsoft has come up with a simple alternative. Seeing that it is only going to

ı few people who use any one icular machine, it would be sim- to carry a "catalog" of their voice erns for the command words and ompare the inputs with these cata- ıed words.

Iowever, since a different inflec- ı in one's voice creates what the nputer would call a different wave- m for the same word, a database of ee samples is kept for each word r person.

Any number of users can be kept the database, provided you have ough memory to hold their voice mmands. Editing a user's voice da- base is easy and adding new com- ands to run new applications is not ifficult.

The Voice Pilot can be used on a ıir range of Windows applications rograms, including Aldus Page- Maker, WordPerfect for Windows and nost of the Microsoft range of Win- lows application programs.

As you can imagine, all this audio processing to carry out commands does slow the machine right down to the point where you may start to think that it would have been quicker to use the mouse in the first place. The point here is that if you want to use this part of the Sound System seriously and speed is very important, you'll need a 486DX at least.

Application audio

If you're using Microsoft Excel for Windows or Lotus 1-2-3 for Windows, you can also take advantage of Sound System's business audio to enhance you business presentations.

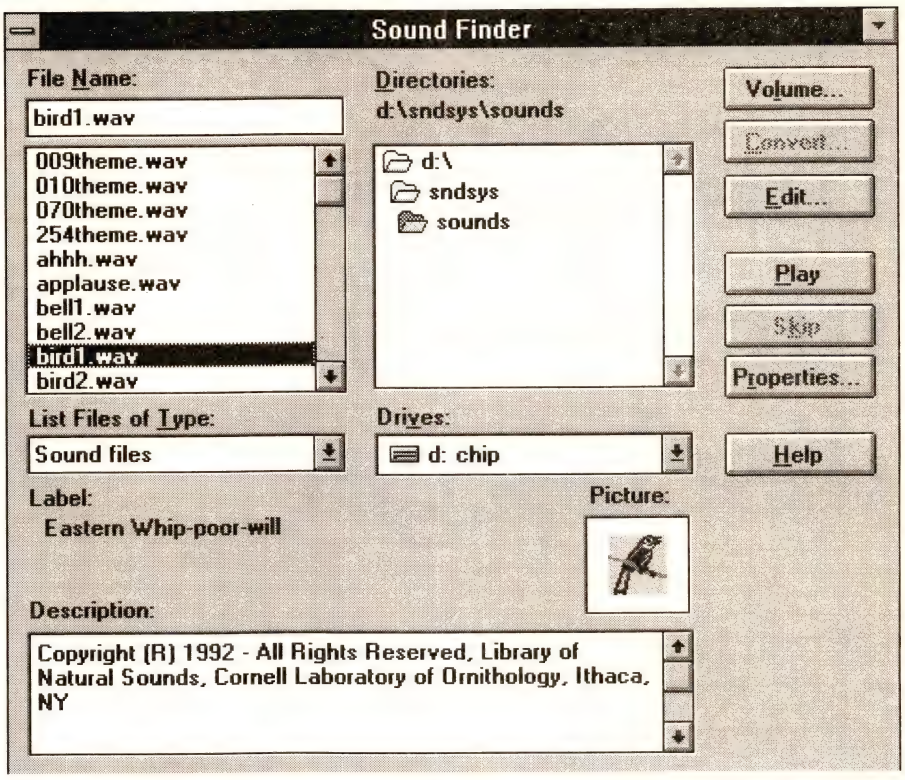
Using Sound System, you can click and drag the cassette icon which represents your audio file into your application and have it play the file directly on cue.

Event-driven sound

Another application of the Sound System software is using it to produce sounds to suit particular events. For example, say you have a PC that is a central machine in the office. Everyone comes to this machine to download or pick up files that are then worked on elsewhere.

A user then comes by and selects a file to delete from the machine. The Sound System can be made to play a message which says, "Do you really want to delete this file, Harry?".

You can assign a sound file to just about any event that can be detected, including questions, exclamations and asterisks that Windows generates upon entering a command.



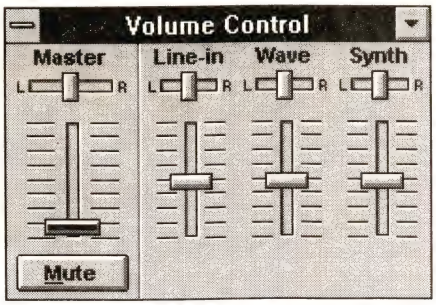
The Windows Sound System comes with 52 pre-recorded sound files, including music samples, birds, elephants & industrial tools. The Sound Finder utility lists these files plus any files you have recorded & lets you play them back.

SoundScapes

Most screen savers look OK for a while but then become boring. SoundScape is the aural equivalent and gives you the chance to generate your own sound environment whenever the computer becomes inactive after a set period of time.

Sound System already has a number of SoundScapes built-in, including Birds and Jungle. If the computer has not been used for a certain time, the screen goes black and the Sound System fires up and begins playing the sound files.

There are about six different bird sounds which are then played at random times, as well as being spaced randomly in the stereo image. Some sounds will appear in the right channel, others in the left, and others as a mixture of the two.



The Volume Control menu allows you to mix three sound sources together, as well as adjust volume & balance. Also featured is a Mute facility.

Music Box

Finally, no sound system would be complete without a CD-ROM interface. You can program the number of tracks and the order in which they are to be played, and even store your favourite CD song lists on your hard disc.

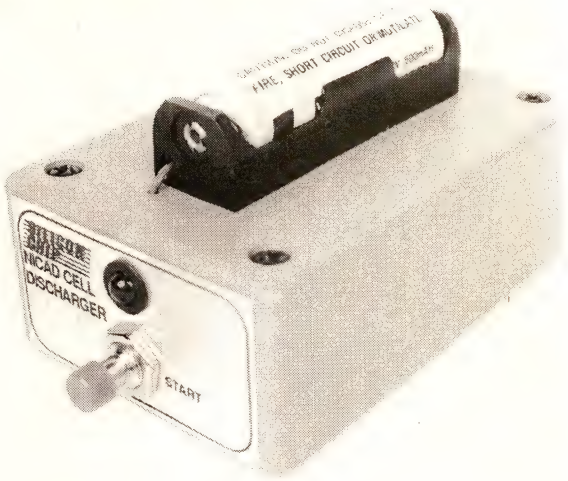
Impressions

By now, you will not be surprised to learn that we think that the Windows Sound System is a real breakthrough. A sound package of this quality has been a long time in the making and will introduce many to the next stage of computing to hit the market.

One of its best features is its price. At only $425, the Sound System is one of the lowest priced serious sound cards on the market. If you're looking for a sound card that does more than just make pretty sounds for games, then this is the one to go for. **SC**

Get maximum life & capacity from your nicad cells

Build this nicad cell discharger



Are you having problems with nicad cells in your battery packs? This low-cost discharger will avoid most of those hassles. It will correctly discharge any nicad cell so that it can be recharged to full capacity.

Design by JOHN CLARKE

Back in July 1992, we published a simple but effective nicad battery discharger for battery packs ranging from 6V to 12V. This has proved immensely popular and so has a more complicated automatic discharger design featured in the November 1992 issue of SILICON CHIP. The latter design was able to discharge battery packs ranging from 3.6V to 12V.

As good as these designs are, they do suffer from one major problem. Ideally, to obtain maximum capacity from a nicad battery pack, each cell should be separately discharged to the "end point" voltage of 1.1V and then each cell should be individually recharged. The reason for this is that individual cells in a battery pack will have differing capacities and therefore when the battery pack is nominally discharged, each cell will have a different voltage. When they are subsequently recharged, maximum capacity will not be obtained.

This problem has no solution when the cells in a battery pack are permanently connected and the connections are inaccessible; ie, when they are sealed inside the package. So for nicad battery packs, one of the discharger circuits referred to above is the only practical solution.

However, if you make up your own battery packs or use single nicad cells in any configuration, you can now obtain the best results with this single cell discharger.

It will discharge any size single nicad cell down to 1.1V whereupon it will turn itself off automatically. After that, the amount of current drawn from the discharged cell is minute (less than 20 microamps, in fact), so you don't have to worry if you leave the cell in the discharger and forget it.

Features

- Discharges either AAA, AA, C or D cells
- Stops discharging at 1.1V cell voltage
- Flashing LED to indicate discharging
- Adjustable discharge current
- 20µA cell current once discharged
- Reverse polarity protection
- Compact design

The discharger requires no externa power supply as it gets its power fro the cell it is discharging. This is th same concept as for the discharge circuits presented in the July and No vember 1992 issues of SILICON CHIP.

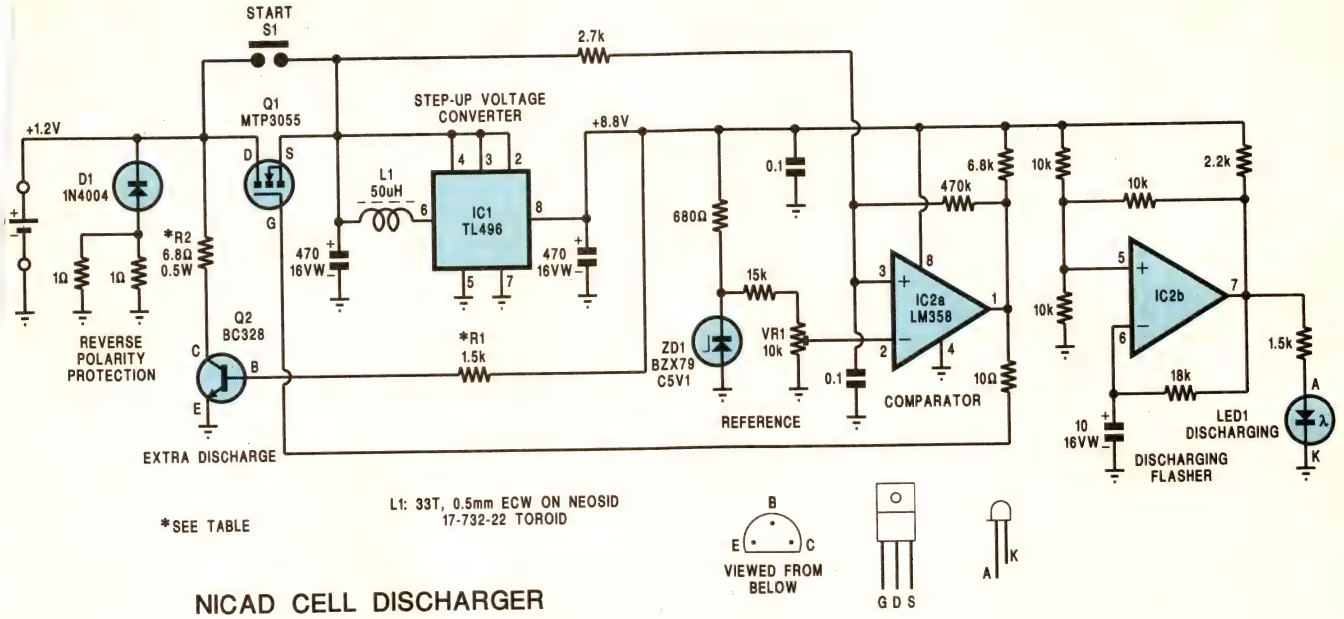
Design approach

A self-powered single cell discharger presents something of problem because the battery voltage is nominally 1.2V and this falls to 1.1V at the end of discharge. This is not enough to power conventional op amps or voltage reference sources, both of which are necessary if the circuit is going to do the job properly.

Our solution to this problem is to use a DC-DC converter to step-up the cell voltage to around 9V. Fig.1 shows the complete circuit.

IC1 is a TL496 DC converter. Power for IC1 comes from the nicad cell via Mosfet Q1. When START switch S1 is pressed, the cell voltage is applied to IC1 and it delivers close to +8.8V across the 470µF electrolytic capacitor at its pin 8 output. This then becomes the supply rail for the remainder of the circuit which comprises a 5.1V zener diode, an LM358 dual op amp (IC2) and a few other minor components.

IC2a is used as a comparator to compare the nicad cell voltage against a reference voltage. The nicad cell voltage is applied to the non-inverting input at pin 3 via a 2.7kΩ resistor. This is compared to the inverting input at pin 2 which is set to 1.1V. This voltage is derived from 5.1V zener diode ZD1 via trimpot VR1.



NICAD CELL DISCHARGER

ig.1: the circuit uses DC converter IC1 to step up the battery voltage to 8.8V 'hen the START switch (S1) is pressed. This rail is then used to power omparator stage IC2a & LED flasher stage IC2b. When the battery discharges to .1V, pin 1 of IC2a goes low, Q1 switches off & removes power to IC1, & the LED tops flashing.

Note that the 5.1V zener diode has a zero temperature coefficient so that the 1.1V reference will not vary with changes in temperature.

With a charged cell connected to the circuit, pin 3 of IC2a will be higher than the reference voltage at pin 2. The op amp output at pin 1 will therefore be high. This voltage is applied to the gate of Q1 which feeds the nicad cell voltage through to IC1 when switch S1 is released.

We have used a Mosfet here since it has only about 40mV across it when it is turned on. To compensate for this 40mV, a 470kΩ resistor is connected between pins 1 and 3 of IC2a. This applies a small amount of hysteresis to the comparator.

When the voltage across the nicad cell drops to just slightly below 1.1V, the output of IC2a goes low, turning off Mosfet Q1. Power is removed from the circuit and Q2 switches off. We haven't described the function of Q2 yet but we'll come to it in a moment.

After Q1 and Q2 switch off, the only power drawn from the nicad cell is the leakage current of Q1 and Q2 which is negligible. We estimate the leakage to be about 40μA.

Discharge indicator

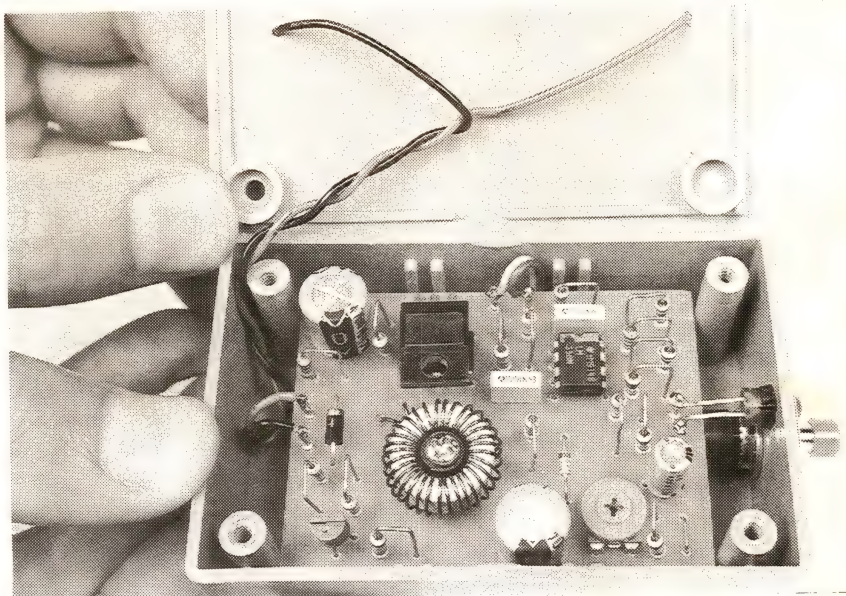
Op amp IC2b is wired as a Schmitt trigger oscillator which is used to flash LED 1 on and off. It operates as follows. The non-inverting input at pin 5 is tied to three 10kΩ resistors – one to the +8.8V supply, one to 0V and the third to the output at pin 7. This voltage divider network means that the 10μF capacitor at pin 6 will constantly be charged and discharged between about +5.9V and +2.9V. At the same time, the output at pin 7 will be a square wave with a frequency of about 3Hz and this drives LED 1 which then functions as a discharge indicator.

Notice the 2.2kΩ resistor at the output of IC2b. This is connected to the +8.8V rail and current is drawn through it when ever the output at pin 7 is low. At other times, when pin 7 is high, current flows through LED 1. Thus, there is current flow via the output of IC2b whether the LED is on or off.

This helps prevent voltage fluctuations from the nicad cell which could otherwise upset the operation of IC2a.

Nicad load current

The total current drawn from the



Most of the parts are mounted on a small PC board which clips into a plastic case. The battery holder is mounted on the lid of the case & is connected back to the board via flying leads. Note that the resistors are all mounted "end-on".

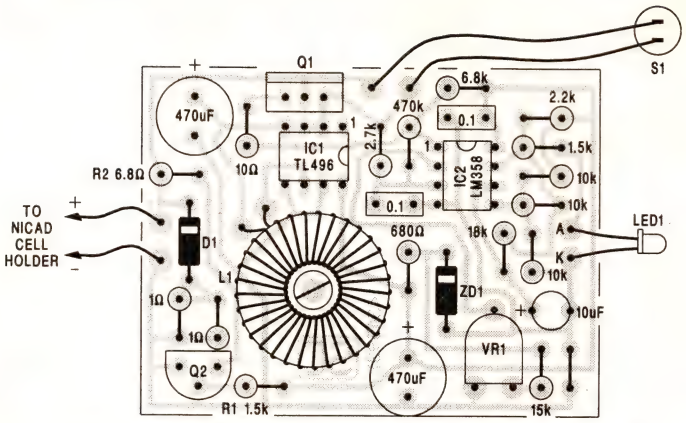


Fig.2: take care with component polarity when assembling the PC board & check Table 1 to see whether or not R1, R2 & Q2 are required. L1 is secured using a transistor insulating bush & a machine screw & nut.

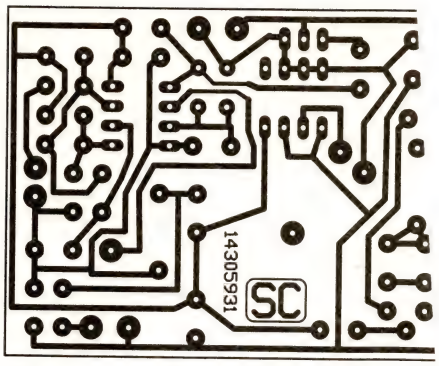


Fig.3: this is the full-size etching patter for the PC board (code 14305931).

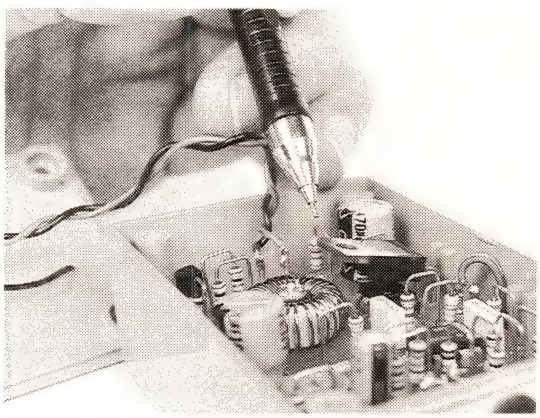
nicad cell while it is discharging comprises the current drawn by the LED flasher, the zener diode reference, the comparator circuit and the step-up converter. This totals about 150mA. This is adequate for discharging AAA and AA size cells but more current is needed to discharge larger cells within a reasonable time. Transistor Q2 provides this extra discharge current.

So if you want to discharge C or D-size nicad cells, you will need to include resistors R1 and R2, plus transistor Q2. Table 1 shows the values for R1 and R2 to suit the various cell capacities. If you wish to discharge cells of different capacities, you will need a rotary switch to switch Q1 and R2 into or out of circuit. Alternatively, you could take the simple approach and build a separate discharger to suit each type of cell in use.

Some readers may question how the addition of Q2 and R1 will increase the current drain from the nicad cell by 70 milliamps. After all, a simple calculation for the current through R1 will give the current as close to 5.5mA (I [8.8V - 0.6V]/1.5kΩ = 5.5mA).

The point to remember here is th the 8.8V supply is being derived v the inverter based on IC1. The volta step up ratio is about 7.3 and after th efficiency of the circuit is taken int account, the nicad cell has to delive about 12mA for every 1mA draw from the 8.8V rail. Hence, when Q and R1 are present, the circuit draw an extra 70mA. In order to draw a extra 180mA, as required for D cells R2 is installed and a total of abou 400mA is then drawn from the cell.

To protect IC1 against incorrect connection of the nicad cell, diode D1 and two 1Ω resistors are included in the circuit. These restrict the reverse voltage across IC1 to less than 1V and thus protect it against damage.



Mosfet Q1 must be bent forwards as shown in this photograph so that it clears the lid of the case.

Construction

We built our prototype Nicad Cell Discharger to suit AA size cells. It is housed in a plastic case measuring 83 x 54 x 30mm and has an AA size cell holder on top. A front panel label

RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	470kΩ	yellow purple yellow brown	yellow purple black orange brown
❑	1	18kΩ	brown grey orange brown	brown grey black red brown
❑	1	15kΩ	brown green orange brown	brown green black red brown
❑	3	10kΩ	brown black orange brown	brown black black red brown
❑	1	6.8kΩ	blue grey red brown	blue grey black brown brown
❑	1	2.2kΩ	red red red brown	red red black brown brown
❑	1	1.5kΩ	brown green red brown	brown green black brown brown
❑	1	680Ω	blue grey brown brown	blue grey black black brown
❑	1	10Ω	brown black black brown	brown black black gold brown
❑	1	6.8Ω	blue grey gold brown	blue grey black silver brown
❑	2	1Ω	brown black gold brown	brown black black silver brown

TABLE 1				
Cell Capacity	Discharge Current	Q	R1	R2
180mAh (AAA)	150mA	no	-	-
500mAh (AA)	150mA	no	-	-
1.2Ah (C)	220mA	yes	1.5k	-
2Ah (C,D)	220mA	yes	1.5k	-
4Ah (D)	400mA	yes	1.5k	6.8 ohms

easuring 48 x 26mm is fitted to the id of the case, along with the push-itton START switch (S1) and the scharge LED.

Apart from LED 1 and switch S1, ll the circuit components are mount-d on a PC board coded 14305931 and easuring 61 x 46mm – see Fig.2. his board is a press fit into the plas-ic case.

After checking the PC board for any lefects such as shorted or open cir-uit tracks, you can begin the assem-oly by inserting six PC stakes at the external wiring points, the two ICs and the diodes. Check the orientation of the ICs and diodes before soldering them in place. This done, insert trim-pot VR1 and the capacitors.

Note that the 470µF capacitors are quite squat – their length is only 12.5mm. We used capacitors from Altronics (Cat. R-5162). If other types are used, they must not be longer than 13mm so that the PC board will fit into the case.

All the resistors are mounted end on to conserve space. You should use your digital multimeter to make sure that you are inserting the correct value resistor in each position. Use Table 1 to check if you need to insert Q2 and resistors R1 and R2.

Mosfet Q1 is mounted with its leads bent so that it can lie horizontally over IC1, while Q2 must be inserted so that it does not sit higher than the electrolytic capacitors. Note that the photograph of our prototype board shows transistor Q2 and resistors R1 and R2 in place, although they would only be needed if large cells were to be discharged.

Inductor L1 is made by winding 33 turns of 0.5mm enamelled copper wire on a Neosid toroid. Pass half the length through the centre of the core and wind on about 16 turns, then use the other end to wind on the rest of the turns. This done, strip the lead ends and solder them into the holes on the PC board. The wound toroid is held in place using a transistor insulating bush and a 3mm machine screw through the centre. Secure it with a 3mm nut on the underside of the PC board.

Fig.3: this full-size artwork can be used as a template when drilling holes for the switch & LED indicator.

The front panel label can now be affixed to the end of the case and the holes drilled for the LED bezel and switch. After attaching the wires to the switch, sleeve the switch end with heatshrink tubing or insulating tape to prevent the bottom of the PC board from shorting to the switch contacts.

Next, connect the switch wires to the PC board, then install the PC board in the case and push the LED into its bezel. The LED leads can now be soldered to the its stakes on the PC board. Make sure that the LED is connected with the correct polarity. Its anode lead is the longer of the two.

The cell holder is attached to the lid of the case using contact adhesive or super glue. We do not recommend using screws and nuts since these could easily short between resistors on the PC board. Drill small holes so that you can pass the cell holder wires through the lid of the case and solder the wires to the PC board pins, as shown in Fig.2.

Testing

To test the unit, rotate VR1 fully anti-clockwise, insert a charged nicad cell into the holder and press S1. The discharging LED should immediately begin flashing. Check that the voltage between pins 4 and 8 of IC2 is about 8.8V and that the voltage across ZD1 is about 5.1V.

If all is well, rotate trimpot VR1 clockwise until LED 1 stops flashing to verify that the comparator is operating. VR1 should then be adjusted so that the voltage between pins 2 & 4 of IC2 is 1.1V (this sets the cell discharge voltage).

The Nicad Cell Discharger is now ready to discharge your cells and help keep them in top condition. **SC**

PARTS LIST

1 plastic utility box, 83 x 54 x 30mm
1 PC board, code 14305931, 61 x 46mm
1 front panel label, 48 x 26
1 single cell holder plus clip lead (see text)
1 momentary pushbutton switch (S1)
1 15mm LED bezel
1 Neosid 17-732-22 iron powdered toroid (L1)
1 1-metre length of 0.5mm enamelled copper wire
1 transistor insulating bush plus screw & nut
1 10kΩ horizontal trimpot (VR1)

Semiconductors
1 TL496 DC converter (IC1)
1 LM358 dual op amp (IC2)
1 MTP3055A or MTP3055E N-channel Mosfet (Q1)
1 BC338 NPN transistor (Q2)
1 1N4002 1A diode (D1)
1 BZX79C5V1 5.1V 500mW zener diode (ZD1)
1 5mm red LED (LED 1)

Capacitors
2 470µF 16VW PC electrolytic (13mm length, see text)
1 10µF 16VW PC electrolytic
2 0.1µF MKT polyester

Resistors (0.25W, 1%)

1 470kΩ	1 1.5kΩ
1 18kΩ	1 680Ω
1 15kΩ	1 10Ω
3 10kΩ	1 6.8Ω 0.5W
1 6.8kΩ	2 1Ω
1 2.2kΩ	

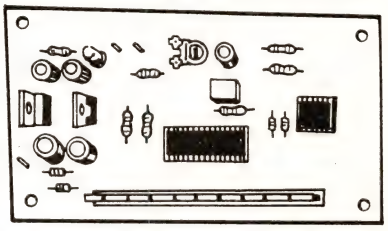
Miscellaneous
Heatshrink tubing for body of S1, tinned copper wire, hookup wire, solder, machine screws & nuts.

We Have A Kit For Everyone Even The Dog!

It's Never Too Late To Save Your Speakers!

Audio Power Meter

Are you worried about burning out your loud speakers? This is a common problem, given the wide dynamic range of today's compact discs. That's why we've developed a kit that monitors power levels. The Audio Power Meter connects across the speaker output terminal of your amplifier (use 2 for stereo) and uses an LED bargraph display to indicate the output power level in 10 steps from 200 milliwatts to 100 watts so you don't have to worry about over-driving your speakers. It comes in short-form with PCB and components including IC sockets so that constructors can easily build it into existing equipment.



April '93

$22.95

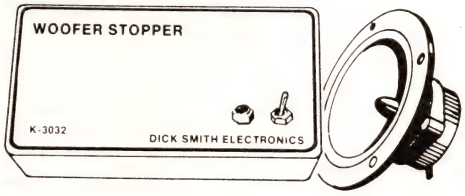
Cat K-5372

You'll Have The Last Bark!

Woofer Stopper

At last a revolutionary kit that will keep the noise down in your neighbourhood! The Super Woofer is an electronic solution to noise pollution of the canine type! Because dogs respond to high frequency noises, the woofer stopper emits a sound which is sensitive to their hearing. It's enough to take the bark out of the meanest dog (without inflicting any harm on it). It comes complete with all components, hardware bits, PCB, case, front panel label, plug pack & piezo speakers.

Cat K-3032



May '93

$59.95

Cat K-3032

Program The Tune Of Your Choice!

Programmable Doorbell

Lets you program your own doorbell tune. With a maximum of 14 notes possible, it can even play two different tunes - one for the front door and one for the back and, if you get sick of a tune, you can change it! The kit comes complete with all components and hardware including battery holder, PCB and a deluxe doorbell case. Back doorbell switch is optional. (Batteries not included)

Cat K-3802 **$39.95**

April '93

Beware Of Units With Less Features!
The Best In Town!

Nicad Battery Discharger

If you want the best performance from your NiCads, get this stylish battery discharger. With switchable voltage (8 ranges in total - 3.6, 4.8, 6.0, 7.2, 8.4, 9.6, 10.8 & 12V), this easy-to-build kit is ideal for most types of NiCads as used in cam-corders, cordless and cellular phones, radio controlled cars, cordless drills and lap-top computers. The unit continuously monitors voltage and automatically cuts off the discharge current when the battery as a whole is fully discharged. There's also a switchable current discharge of 50mA and 200mA and a push-to-start button. This full-form kit has all components, hardware, case and a pre-punched (black anodised) screened front panel.

$34.95

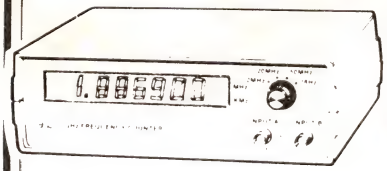
Cat K-3126

Nov '92

More Affordable Than Ever!

1GHz Frequency Counter

This 1GHz counter is an inexpensive variation on the 50MHz counter design published in February '93 Electronics Australia. By substituting an uprated display module and adding to the prescaler circuitry, a truly ingenious 1GHz counter can be built. The unit is designed with a seven digit display including a 'KHz/MHz' status indicator and a frequency range selector so that the user can select the relevant range ie: 2MHz, 20MHz, 50MHz & 1GHz. The Kit includes case, PCB, all components, hardware and a pre-punched and screened, perspex front panel.



$159

Cat K-7604

Frequency Range: Input A: 0-50 MHz
Input B: 50-1GHz

Input Impedance: Input A: 1M OHM
Input B: 50 OHM

April '93

Two Channel Camcorder Mixer

One of the things that decides whether a home video movie is a bore or a block-buster is the soundtrack. This inexpensive kit makes it easy to give your videos that Hollywood feel, complete with music and sound-effects! 9V battery powered, the kit comes in full-form with PCB, case, front panel label, hardware, battery holder and all components, including IC socket. (Battery not included)

$29.95

Cat K-5408

March '93

PLEASE CHECK YOUR NEAREST STORE FOR AVAILABILITY, AS SOME KITS MAY STILL BE IN PRODUCTION.

arance!

'cular Bright 300 mcd d Led

Z-4075

$1 *Normally* **$1.65**

-line Fuseholder

'ect for car radios, transceivers or any low voltage lication. You can attach your own cabling and there's no ance restriction! It takes standard 3AG fuses and comes nplete with all hardware.

P-7911

85¢ 10 UP 70¢

leavy Duty 12 Volt Relay

low-cost heavy-duty 12-volt relay that's ideal for cars. This uality Japanese-made relay has 25 amp single-pole vitching contacts and its casing includes easy-mount racketing spade lug terminals for super-fast termination.

at P-8040

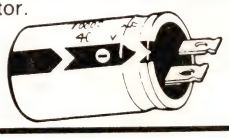
$12.95

Clearance!

Electrolytic Capacitor

3600 mfd 40V RG/CAN type computer grade lug mount electrolytic capacitor.

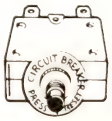
Cat R-4570



$4.95

Circuit Breakers

Unlike the existing P-8201 to P-8210 32V AC circuit breakers, this range has a higher 50/250 volt AC rating. They are incredibly good value - you won't find them for less at any other retail store!

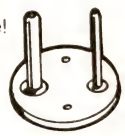


3 Amp	Cat P-9900	$5.95
5 Amp	Cat P-9902	$5.95
10 Amp	Cat P-9904	$5.95

2-Pin 9-Volt Battery Plug

As used in valve radios. There are hundreds of other uses - maybe you can think of some!

Cat P-3030



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B1479

BUILD THE WOOFER STOPPER!

Do you have a noise pollution problem of the canine type? If so, then don't take "woof" for an answer – zap it with the Woofer Stopper!

By DARREN YATES

Let's face it – there are fewer things in life more annoying than a dog barking at 4 o'clock in the morning. It doesn't matter what your problem is, it is seemingly insignificant when stacked against a flea-bitten mutt with the urge to howl in the wee-hours!

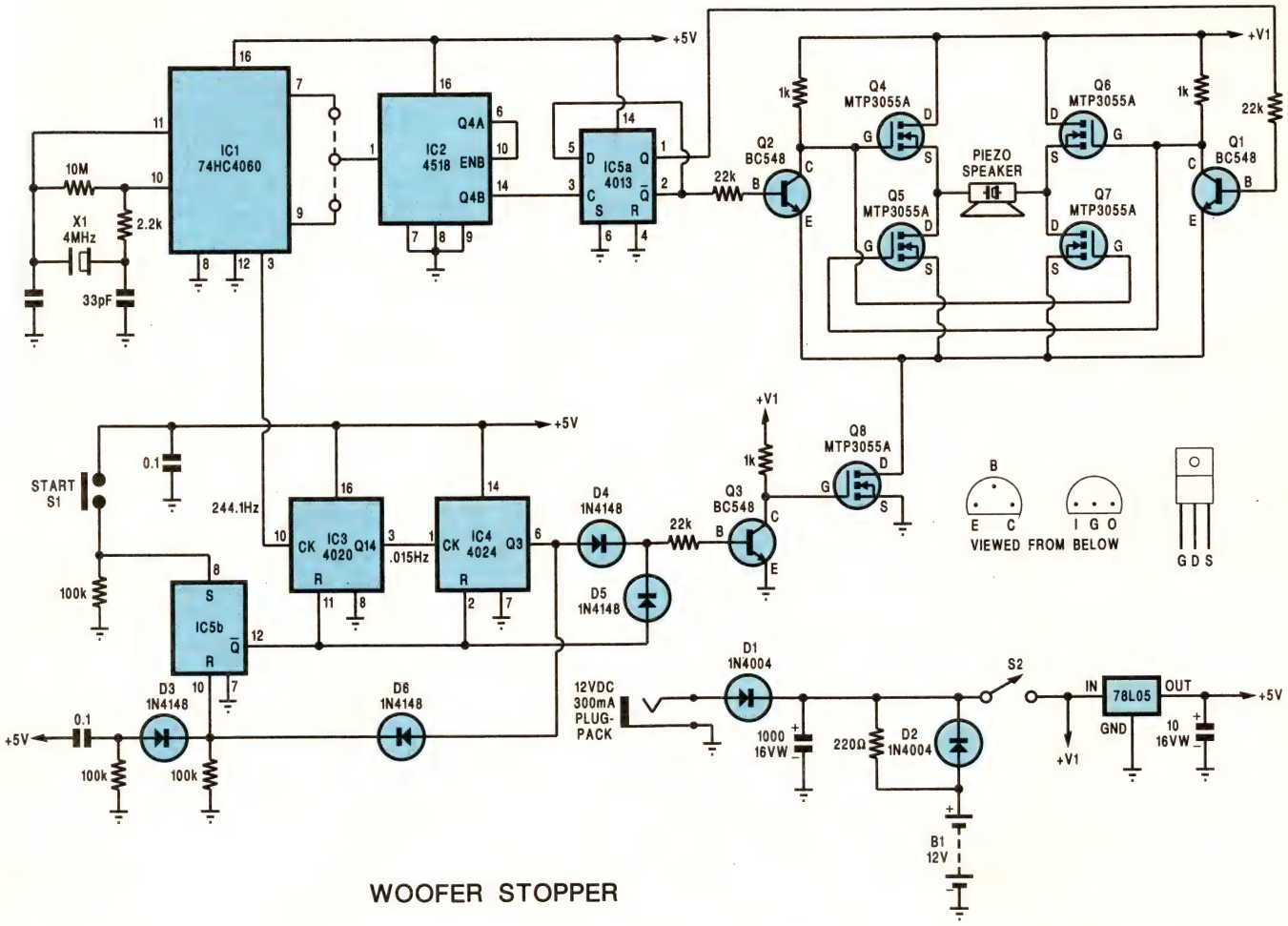
It's also quite amazing how many owners disregard the noise their dogs make and the discomfort they cause other people. So much so, that barking dogs are a common source of friction between neighbours in urban areas.

However, there are several plans of attack for the frustrated neighbour. These involve exploding cans of dog food, armed combat with the offending mutt, and forcing it to watch endless re-runs of "Benji". Others are less savoury and we cannot mention them here but none are as elegant as our Woofer Stopper!

We have had many requests for a dog zapper that really works – nothing to injure the animal mind; just something to act as a reprimand and make the dog shut up. The Woofer Stopper is the result of our endeavours. At the press of a button, it emits a retaliatory high-level supersonic tone that lasts for about nine minutes.

Because this tone has a frequency of about 20kHz, it's beyond the range of human hearing but is well within the hearing range of a dog. The idea behind the device is that it packs a big enough aural punch to chastise the dog and knock the bark out of it. Basically, it's the high-tech equivalent of the good old fashioned but often ineffective "shaddup-yer-barking" bellow out the window.

What's more, if the device is used on a regular basis, the animal eventually realises that it is going to be reprimanded if it barks and eventually ceases to be a problem. But the real beauty of the device is that your inconsiderate neighbour doesn't even know that you're getting your own back on his equally inconsiderate mutt. And of course, you can get back



WOOFER STOPPER

Fig.1: the circuit uses IC1 & crystal X1 to generate a 4MHz timing signal which is divided down to 20kHz by IC2 & IC5a. IC5a provides complementary square wave outputs & these drive transistors Q1 & Q2 which in turn drive an H-pack output stage consisting of Q4-Q7. IC3, IC4 & IC5b form the 9-minute timer.

to sleep while the dog it still in the process of being zapped.

Who was it that said "every dog has his day"?

And now for the $64,000 question. Does it work? Well, from our own limited trials the answer is a resounding yes but we cannot guarantee that it will work with every dog. There are several reasons for this. First, some dogs are just plain stupid and that's all there is to it. Second, many older dogs are deaf and so wouldn't realise that they were being zapped by the Woofer Stopper, although older dogs are generally not problem barkers.

And third, the range of the device is fairly limited which means that the dog has to be no more than about two doors away. A range of about 20 metres has been proven in practice but we haven't really had an opportunity to check the effectiveness of the device over longer distances.

It certainly wouldn't stop a dog that's barking at the other end of the street.

Circuit details

Initially, we had ideas of a sound-operated mechanical arm that dropped half a house brick on the dog's head. However, most of the SILICON CHIP staff are dog lovers and insisted that this idea be scrapped in favour of an entirely electronic approach.

Refer now to Fig.1 for the circuit details. We'll go through each circuit section step-by-step and explain how it all works.

Timing for the circuit is provided by IC1, a 74HC4060 high-speed CMOS 14-bit counter and oscillator whose frequency is set by a 4MHz crystal. The reason for using the "HC" version of the 4060 is that a standard CMOS type cannot be expected to run reliably at 4MHz with only a 5V supply.

The two 33pF capacitors provide the correct loading for the crystal so that it always starts reliably when power is applied to the circuit.

The output from IC1 is taken from pin 9, which is the direct 4MHz output from the oscillator. This is fed into IC2, a 4518 dual BCD counter configured as a divide-by-100 circuit. The resulting output at pin 14 (Q4B) is a pulse waveform with a frequency of 40kHz.

From there, the signal is fed into D flipflop IC5a which divides by two. This not only divides the signal down to the 20kHz we want but also provides 50% duty cycle complementary square wave outputs at pins 1 and 2.

Mosfets Q4-Q7 form an H-pack output stage in which diagonally opposite devices alternately conduct together, with the output device (a piezoelectric tweeter) forming the bridge in the middle. Each Mosfet is an N-channel device which means that it turns on when its gate voltage is higher than its source voltage.

The complementary signals from IC5a appear at pins 1 and 2 and drive transistors Q1 and Q2 respectively via 22kΩ resistors. These two transis-

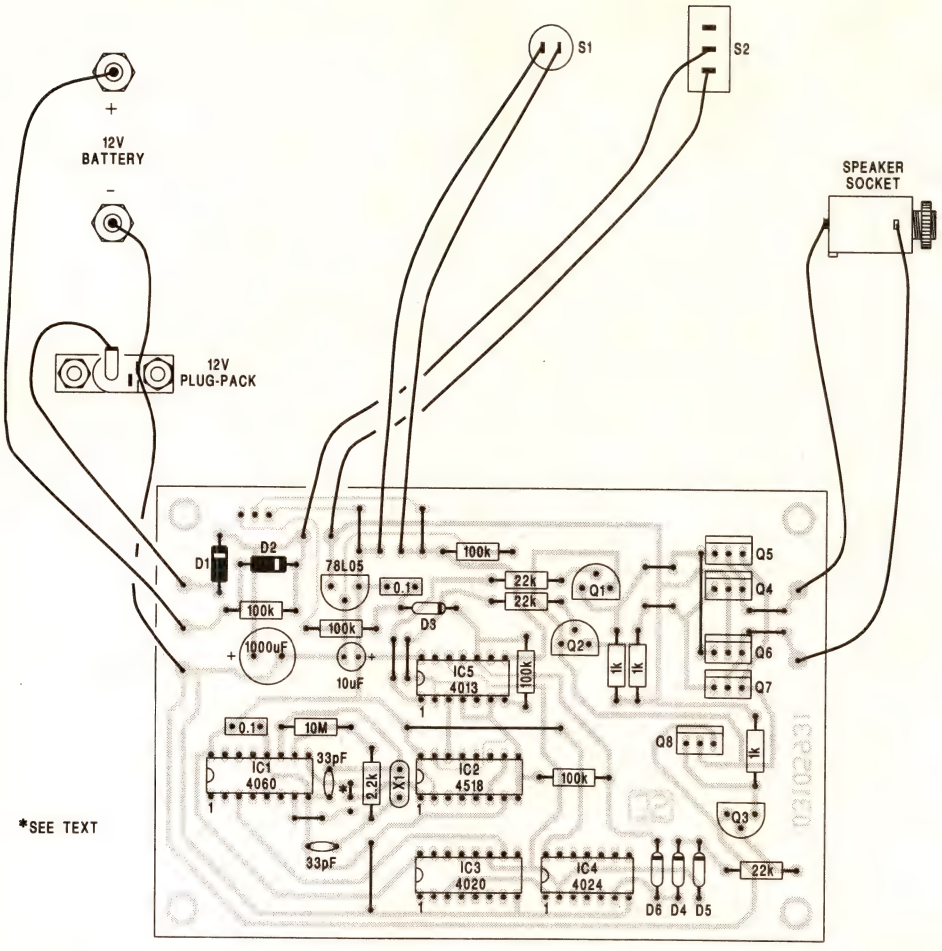


Fig.2: install the parts on the PC board & complete the wiring as shown here. Note the three vacant pads between IC1 & X1. To test the circuit, link the middle & bottom pads so that the tweeter delivers a 2kHz tone. When testing is complete, remove this link & link the middle & top pads instead.

tors then provide the necessary drive current for the H-pack output stage. The H-pack output stage in turn is switched on and off by Q8 which forms part of the timer circuit.

For example, let's assume that Q1 is on (ie, pin 1 of IC5a is high) and that Q2 is off. Assuming that Q8 is also on, this means that Q4 and Q7 will be on and so current flows from the supply rail, through Q4, through the piezo tweeter, through Q7 and then through Q8 to ground.

When the outputs of IC5a toggle, Q4 & Q7 turn off and Q6 & Q5 now switch on. Current now flows from the supply rail through Q6, through the tweeter in the opposite direction to before, and then through Q5 and Q8 to the ground rail.

Because both ends of the tweeter are alternately switched between the positive supply rail and ground, we actually get twice the supply voltage developed across the tweeter. This ensures that the tweeter delivers adequate punch (the power is almost quadrupled), despite the limited supply voltage.

As well as providing the initial timing signals for the H-pack output s IC1 also forms part of the delay t circuitry. Its pin 3 output delive 244Hz square-wave signal (ie, 4MHz clock signal divided by and this is then fed to IC3.

IC3 is a 4020 14-stage binary co ter and is used to divide the 24 signal on its CLK input (pin 10) b further 2^{14}. The resulting signal then divided by eight by 7-stage nary counter IC4 to produce a wa form which goes low for 536 secor (ie, slightly less than nine minute During this time, Q3 will be off and Q8 turns on to enable the H-pack ou put stage (Q4-Q7).

Reset circuit

Flipflop IC5b performs several rol in the circuit. First, it ensures that IC and IC4 are correctly reset when pow is first applied and at the end of eac timing cycle. Second, it releases th reset lines on IC3 and IC4 and allow them to count when the START but ton (S1) is pressed. And third, it turn Q3 on outside the timing period t disable the H-pack output circuit.

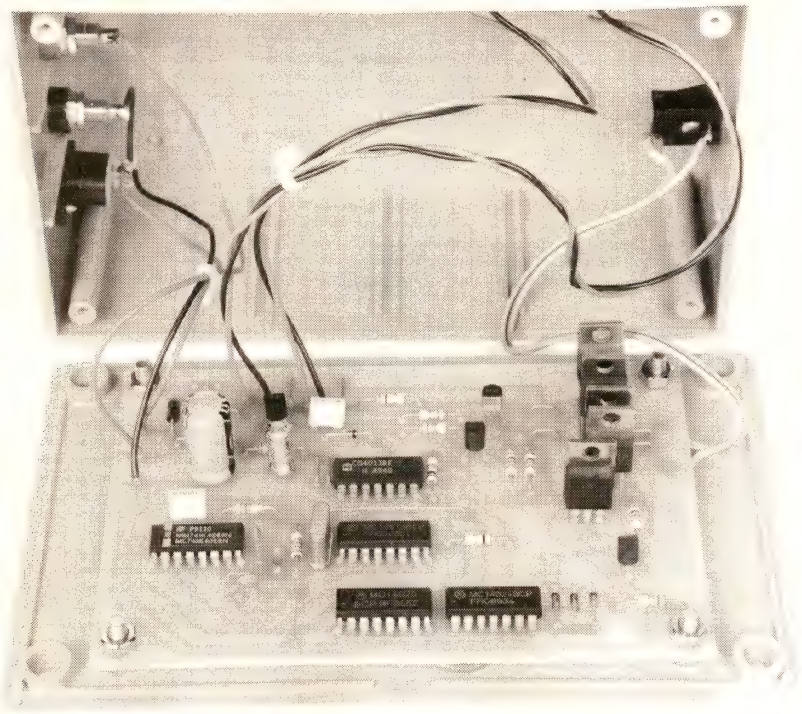
When power is first applied, pin 1((reset) of IC5b is momentarily pulled high via a 0.1µF capacitor and diode D3. This resets IC5b and so its Q-bar output (pin 12) goes high and also resets IC3 and IC4. At the same time, it turns on Q3 via D5 and thus Q8 is off and the siren driver circuit (ie, the H-pack output stage) is disabled.

When the START button (S1) is subsequently pressed, IC5b's set input is momentarily pulled high and so its Q-bar output switches low. This turns Q3 off and so Q8 now turns on to enable the siren diver circuit.

IC3 and IC4 now begin counting up in response to clock signals from IC1. After about nine minutes, pin 6 of IC4 switches high and turns on Q3 via D6 to switch the siren off again. This high also resets IC5b via D4 which means that Q-bar of IC5b switches high again and resets IC3 & IC4, ready

RESISTOR COLOUR CODE

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	10MΩ	brown black blue brown	brown black black green brown
❑	3	100kΩ	brown black yellow brown	brown black black orange brown
❑	3	22kΩ	red red orange brown	red red black red brown
❑	3	1kΩ	brown black red brown	brown black black brown brown
❑	1	220Ω	red red brown brown	red red black black brown



The PC board is secured to the lid of the case using machine screws & nuts, with additional nuts used as spacers. Make sure that all polarised components are correctly oriented.

PARTS LIST

1 PC board, code 03105931, 123 x 82mm
1 plastic zippy case, 198 x 113 x 62mm
1 momentary pushbutton switch (S1)
1 SPST toggle switch (S2)
1 black banana socket (optional)
1 red banana socket (optional)
1 2.5mm DC socket
1 3.5mm mono socket
1 12VDC 300mA plugpack
1 piezo tweeter (Jaycar Cat. CT-1907, DSE Cat. C-2005)
1 4MHz crystal

Semiconductors

1 74HC4060 14-bit counter & oscillator (IC1)
1 4518 dual BCD counter (IC2)
1 4020 14-bit binary counter (IC3)
1 4024 7-bit binary counter (IC4)
1 4013 dual D flipflop (IC5)
1 78L05 5V 100mA regulator
3 BC548 NPN transistors (Q1-Q3)
5 MTP3055A or MTP3055E power Mosfets (Q4-Q8)
2 1N4004 silicon diodes (D1,D2)
4 1N4148, 1N914 diodes (D3-D6)

Capacitors

1 1000µF 16VW electrolytic
1 10µF 16VW electrolytic
2 0.1µF 63VW MKT polyester
2 33pF ceramic

Resistors (0.25W, 1%)

1 10MΩ	1 2.2kΩ
3 100kΩ	3 1kΩ
3 22kΩ	1 220Ω

Miscellaneous

Hook-up wire, solder, screws, nuts & washers

for the next timing cycle. The high on Q-bar of IC5b also now holds on Q3 (via D5) and thus the siren is disabled until the START button is pressed again, whereupon the cycle repeats itself.

Power for the circuit is derived from a 12VDC plugpack supply, with optional back-up provided by a 12V rechargeable battery (either nicad or SLA).

As shown in Fig.1, the incoming DC from the plugpack is fed via reverse polarity protection diode D1 and switch S2 to a 3-terminal 5V regulator. The output from the regulator is then used to power the ICs, while the siren driver circuit is powered from the 12V supply on the input side of the regulator.

Construction

The Woofer Stopper is built onto a PC board measuring 123 x 82mm and coded 03105931. Fig.2 shows the wiring details.

Before installing any of the parts, check the PC board carefully for etching defects by comparing it with the published pattern. Usually, there will be no problems here but it's always best to make sure.

Assuming everything is OK, begin the board assembly by installing the 12 wire links (don't forget the link between the gates of Q5 & Q6). The resistors and capacitors can then be installed on the board, followed by the diodes, ICs and transistors in that order.

Make sure that all polarised parts are correctly oriented and be sure to use the correct part at each location. In particular, note that diodes D1 & D2 are 1N4004 types, while diodes D3-D6 are 1N4148s (or equivalent).

The five Mosfets (Q4-Q8) are all installed with their metal tabs towards the back of the PC board, as viewed in Fig.2 (see Fig.1 for the pin connection details). Push these devices down onto the board as far as they will comfortably go before soldering their leads. Finally, complete the board assembly by installing the 4MHz crystal (it can go in either way around).

Testing

The completed board assembly must now be tested to confirm that it is operating correctly. How do you test the circuit when you cannot hear its output? The answer is to modify the circuit slightly so that it produces a 2kHz tone instead of a 20kHz tone.

The first step is temporarily connect the START switch, DC input socket and the tweeter to their respective pads. This done, take a close look at the PC board and locate the three vacant pads between IC1 and the 4MHz crystal.

These pads are used as a crude switch, with the centre pad as the wiper. When the middle and top pads are bridged, the circuit produces a 20kHz tone. When the middle and bottom pads are bridged, the circuit

Fig.3: this ful size artwork be used as a drilling temp for the two fr panel switche

produces a 2kHz tone (ie, the clock signal is now taken from pin 7 of IC1).

To test the unit, link the middle and bottom pads, connect the plugpack supply and switch on. Now press the START button. You should immediately be greeted by a 2kHz tone from the tweeter. In fact, it's a good idea to cover the tweeter with a blanket before switching on to lessen the impact on your eardrums.

The next step is to check the timing circuitry by confirming that the tweeter stops sounding after approximately nine minutes. If you cannot stand to have the tweeter blaring away for this period of time, switch off, disconnect it and connect your multimeter (set to the 20V range) to the collector of Q3. This done, switch on and press the START switch again.

Q3's collector should immediately go high (ie, to +12V). It's then simply a matter of confirming that Q3's collector goes low again some nine minutes later to end the siren period.

Once you've confirmed that everything is operating correctly, remove the link to the bottom pad and link the middle and top pads instead. The circuit will now produce the desired 20kHz square-wave.

The three unused pads near diodes D1 & D2 interface to an optional remote control receiver (to be described next month).

Final assembly

All that remains now is to install the board inside the specified plastic case. The PC board mounts on the lid of the case (which now becomes the base) and can be used as a template for marking out its own mounting holes. Secure the board to the lid using machine screws and nuts, with additional nuts used as spacers.

You will also have to drill holes in both ends the case to accept the power input sockets and the output socket, plus holes in the front panel for the two switches. A 2.5mm DC socket is used for the plugpack supply, banana sockets are used for the battery and a 3.5mm mono socket is used for the output to the tweeter.

If you don't wish to use the optional back-up battery, just leave its terminals out of circuit and omit D2 and its parallel 220Ω resistor.

Finally, try to position the tweeter as close to the offending dog as possible, while keeping it (the tweeter that is) out of the weather. Probably the best location is under the eaves of your house. **SC**

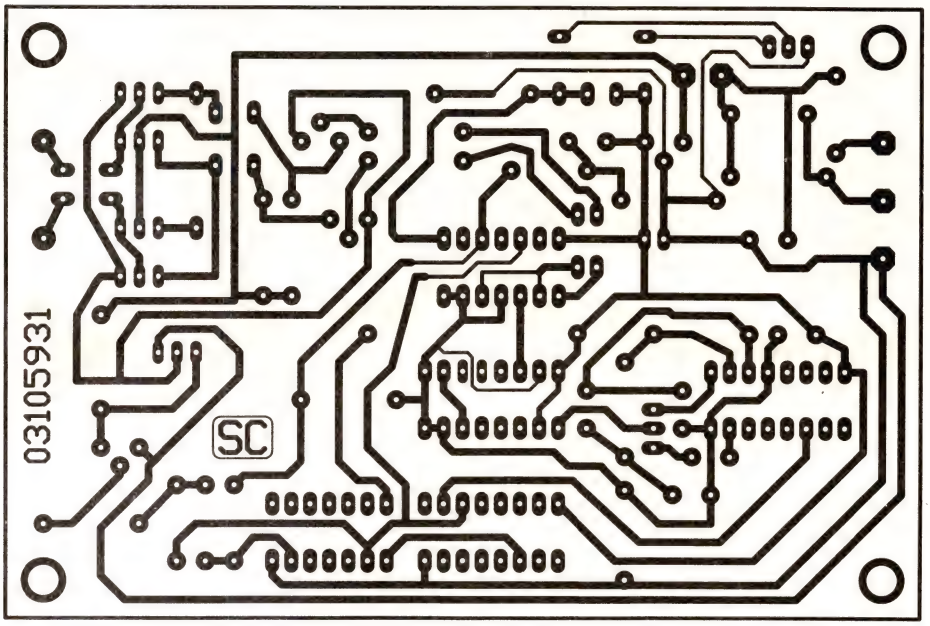
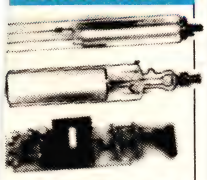


Fig.4: this is the full-size etching pattern for the PC board.

12V OPERATED LASER TRIO



One used 3mW Siemens tube, one used laboratory quality 2mW tube, one universal 12V laser inverter kit, for a total of:

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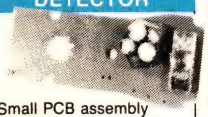

Small PCB assembly based on a ULN2232 IC. This device has a built in light detector, filters, timer, narrow angle lens, and even a siren driver circuit that can drive an external speaker. Will detect humans crossing a narrow corridor at distances up to 3 metres. Much higher ranges are possible if the detector is illuminated by a remote visible or IR light source. Can be used at very low light levels, and even in total darkness with IR LED. Full information provided. The IC only is worth $16! Our price for the assembly is:

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ON SPECIAL AT:

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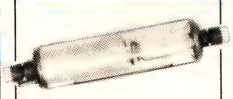

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Includes one "Free" rifle or pistol mount.

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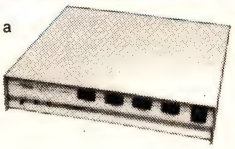

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The giveaway price for the complete unit? **$60**

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Use it to charge and or maintain batteries on boats, for lighting, solar powered electric fences, etc. Make your own 12V-4W solar panel. We provide four 6V-1W solar panels with terminating clips, and a PCB and components kit for a 12V battery charging regulator and a three LED charging indicator. See March 93 S.C. Incredible value!

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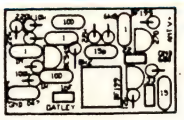
$550

FOR THE TUBE AND THE SPECIFICATION SHEET

FM TRANSMITTER KIT — MkII



This HIGH QUALITY — LOW COST FM transmitter should not be compared to other simple designs. The frequency shift due to extreme antenna handling, and or changing the supply voltage by ± 1V at 9V will produce less than 30KHz deviation at 100MHz! Less than 0.03% shift: STAYS PUT! It has very high audio sensitivity. It will pick up sound sources 10's of metres away from the microphone.

Transmitter Specifications: Supply voltage 6-12V, Consumption @ 9V = 3.5mA, 50uS pre-emphasis, 40Hz to greater than 15KHz response, greather than 60dB S/N ratio, audio sensitivity: 20mV, frequency stability (see notes): 0.03%. PCB dimensions: 26mm X 42mm. A solder masked and silk screened PCB and a prewound shielded coil make for easy construction. The kit includes the PCB plus all the on-board components, an omnidirectional electret microphone, and a 9V battery clip, at a TOTAL COST of:

$11

Or you can purchase three kits for a total of $30.

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20KV PIV–5mA Av./1A Pk. Fast diodes ..... $1.50 ea.
3KV PIV–300mA/30A Pk. Fast diodes ..... 60c ea.
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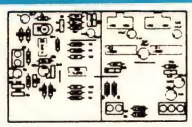
High quality UNIDIRECTIONAL ELECTRET microphone inserts $8.50
Stage quality UNIDIRECTIONAL DYNAMIC microphone inserts $9.60
780nM IR diochroic filter (20nM bandpass) for IR detectors $20
FRONT SURFACED MIRRORS:
10mm X 10mm X 1mm $5
20mm X 20mm X 1mm $6
200mm X 150mm $8

X-Y LASER SCANNER KIT



Commercial X-Y scanners for laser deflection cost thousands of dollars. This scanner compromises by using two DC motors to achieve good results. The motors don't spin, but simply vibrate around the set position. The PCB and component kit include rectification and filtering (power supply), audio preamplifiers, audio filtering, and two separate power amplifiers to drive the two deflection motors. The scanner is powered by a 16V AC–900mA plugpack. Produces a totally randqm two dimensional display which is depended on the sound picked up by the microphone. The power amplifiers can also be driven from external oscillators and/or pre-taped signals recorded on a stereo cassette recorder. A short form kit includes a screened and solder masked PCB, all the on-board components, an electret microphone, two motors, and two lightweight mirrors:

$44

240V–16V/900mA AC-DC Plugsafe: $16 extra.

MORE UNUSUAL ITEMS AND COMPONENTS

100 LED BARGRAPH DISPLAY: Yes 100 LEDs, plus IC control circuitry, all surface mounted on a long strip of PCB. Simple, a 4 bit binary code selects which one out of the 10 LED groups will be on, whilst another 4 bit binary code selects which one of each group of 10 LEDs will be ON. Latching inputs are also provided. We include a circuit and a connecting up diagram. Special introductory price .. $7 ea.

MINIATURE FM TRANSMITTER: Ready made and enclosed in a small black metal case which also contains the small battery (G13) and a microphone: 32 X 32 X 11 mm. We don't recommend this use, but some would advertise this unit as a miniature "bug" at many times more than our price of $39.50

FM MICROPHONE: Features a stainless steel case and an unidirectional microphone insert, powered by two AA batteries. High quality at $39.50

OATLEY ELECTRONICS

PO Box 89, Oatley, NSW 2223

Telephone: (02) 579 4985 Fax: (02) 570 7910

MAJOR CARDS ACCEPTED WITH PHONE AND FAX ORDERS

P & P FOR MOST MIXED ORDERS:

AUSTRALIA: $6; N.Z. (Air Mail): $10

A remote volume control for hifi systems

Have you ever wanted to adjust the volume of your stereo system from the comfort of your armchair? Now you can with this high quality Remote Volume Control. It can control the balance setting too & has excellent distortion & noise specifications.

By JOHN CLARKE

How many times have you been listening to your favourite piece of music and wanted to adjust the volume? Many CD players now have remote volume control but other program sources don't. This Remote Volume Control overcomes that problem and can be added to just about any system.

Apart from having infrared remote control, this project overcomes the limitations of the standard dual ganged potentiometers which are used for volume adjustment on almost every amplifier. All normal potentiometers become noisy with use and since the volume control is the one we use most, it is the most likely control on your amplifier to become noisy.

A second problem with volume control potentiometers is their poor "tracking" between the left and right channels, particularly at low volume settings. This means that as you turn the volume down, the sound tends to shift to one side of the room and then needs adjustment with the balance control. With the SILICON CHIP Remote Volume Control, there is no noise because there are no moving parts and the tracking between channels is superb – better than any dual-ganged potentiometer can ever be.

There is also negligible distortion and excellent separation between channels and you can set the volume level far more precisely than with any normal volume control.

The SILICON CHIP Remote Volume Control unit is housed in a one-unit high (ie, 44mm-high) rack-mounting case. It can be connected between your preamplifier and power amplifier if you have separate units. Alternatively, it can be connected into the Tape Monitor loop of an amplifier or stereo receiver. A separate Tape Monitor loop is built into the unit so that you don't lose this facility.

As a matter of fact, if you normally use a CD player and tape deck as your only program sources, you could use this Remote Volume Control in front of a power amplifier in what would appeal to purists as "minimalist hifi". The system would have no input selector (apart from the Tape Monitor switch), no tone controls and no knobs. In fact, one of our staff members has used just such a system in conjunction with the Studio 200 power amplifier described in the February 1988 issue of SILICON CHIP.

The audio performance of the Renote Volume Control is genuinely hifi. As can be seen from the specifications, the noise and distortion are extremely low and separation between channels is excellent. What the figures mean is that the sound quality will not be degraded in the least.

Block diagram

Fig.1 shows the main features of the unit. The infrared remote control transmitter unit has five buttons: Up and Down volume, Left and Right balance, and Mute. The Up, Down and Mute buttons are duplicated on the Remote Volume Control unit itself.

The volume setting is displayed on a digital readout which shows the attenuation in decibels from 0dB (maximum volume level) down to -88.5dB. The volume setting can be changed via the Up and Down buttons in 1.5dB steps. If you hold down the Up button, the volume setting will increase at a rate of about 6dB per second. Similarly, the Down button causes the volume setting to reduce by 6dB per second. This rate is about the same as that provided by the motor-driven remote controls on some commercial amplifiers.

Balance display

The balance display is a 9-LED bargraph which simulates the setting of a horizontal slider control. When the balance is centred, the centre LED lights. When the balance is shifted to the right, the LEDs to the right will be successively lit and vice versa.

Balance adjustment is made in 1.5dB steps from 0dB to 9dB and then fully off. Three LEDs either side of centre indicate 3dB balance steps (ie, -3dB, -6dB and -9dB), while two LEDs lit at the same time indicate the in-between steps (ie, -1.5dB, -4.5dB and -7.5dB). When the extreme left LED is on, the right channel is fully off. Similarly, when the extreme right LED is on, the left channel is off.

The Mute facility enables you to reduce the gain by 21dB – similar to the mute control on normal amplifiers. The mute condition is indicated by seven of the nine balance LEDs lighting up. When the balance display is indicating the mute mode, balance adjustment is not possible.

All nine LEDs of the balance display light in mute mode when the volume setting is -67.5dB or more. This simply indicates that both channels are muted beyond the normal -88.5dB range.

The heart of the remote volume control circuit is a 68HC705C8P microprocessor. This is used to drive the digital readout and LED balance display, and to monitor the signal from the infrared remote control. However, its main function is to drive a dual logarithmic digital to analog (D-A) converter. It is this device which controls the level of the audio signal.

Static idle

One problem that can occur when using a microprocessor in audio equipment is noise injection due to the high speed switching of its internal circuitry. This can be minimised by careful layout and shielding but the only really effective way to stop it is to shut down the microprocessor. To do this we use a method known as "static idle". This means that the microprocessor is only active when it is updating volume or balance settings and is static at other times.

This facility is normally used in order to save power consumption in battery operated microprocessor applications. We're not concerned about power consumption here; just about noise.

The companion remote control transmitter has five pushbuttons to control volume (Up & Down), balance (Left & Right) & muting.

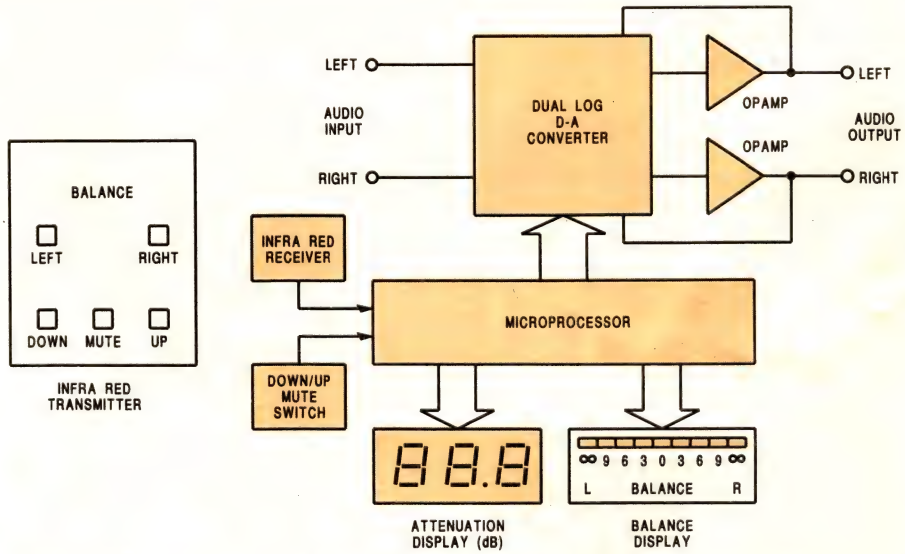


Fig.1: block diagram of the Remote Volume Control. The microprocessor decodes the incoming code picked up by the infrared receiver & controls an A/D converter to vary the audio signal level. It also indirectly drives the LED displays to show the volume level & channel balance.

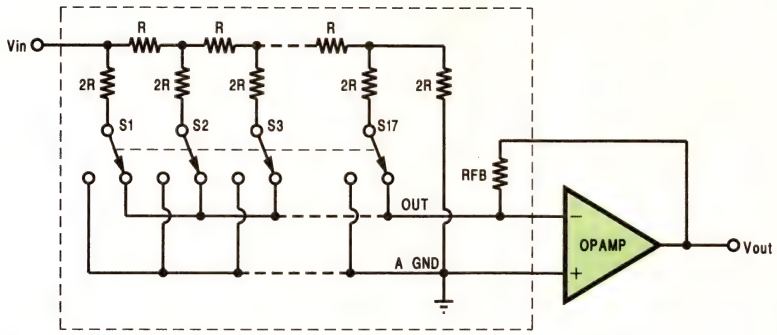


Fig.2: the arrangement for a standard 17-bit R-2R D/A converter. In this application, the D/A converter is used as a programmable resistance to control the gain of an op amp & thus the audio level at the output.

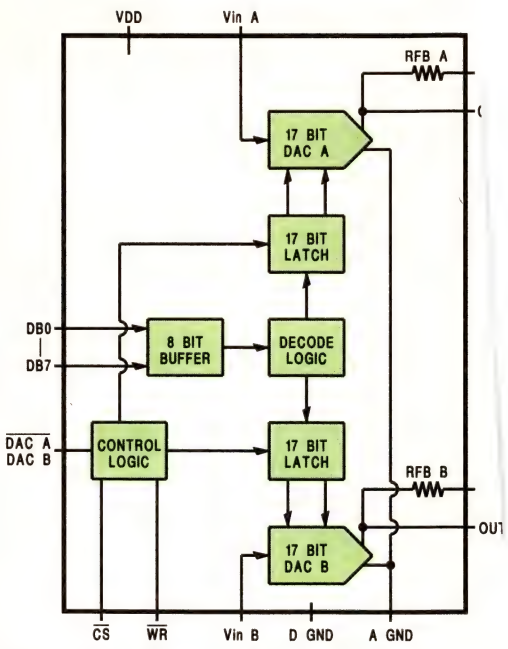


Fig.3: block diagram of the AD7112 D/A converter IC. It has eight data inputs & these are buffered & decoded to control two 17-bit D/A converters (DACs), thus making it ideal for use in a stereo system.

A dual logarithmic D/A converter is used to control the volume of the audio signal. However, analog to digital conversion and back again does not happen. All signals remain analog. How can this be?

The answer is that we are not using the D/A converter to perform any signal conversion. Instead, we are using it as a programmable resistance.

Basic concept

Fig.2 shows the concept. This diagram depicts the arrangement for a standard R-2R D/A converter. The voltage at V_{in} is applied to the inverting input of an op amp via a series string of resistors of value R which are shunted with resistors of value 2R. The 2R value resistors can be connected independently either to the inverting input of the op amp or to ground via switches S1-S17.

Note that we are using a 17-bit D/A converter (ie, with 17 switches) but only four bits are shown.

In normal D/A use, the Vin terminal is supplied with a fixed reference voltage of typically +5V. When all switches (S1-S17) connect to the OUT position, the 5V at Vin passes directly to the op amp output. If all the switches are connected to ground, then the signal is attenuated by a factor of 2^{17}, or to about 38μV. Other settings of the switches provide voltages which are between these two values.

Our circuit does not use 5V DC but applies the audio signal to Vin. Hence, the signal at the output of the op amp can be directly controlled by the D/A converter.

The DAC we have selected is the AD7112 from Analog Devices. Its internal block diagram is shown in Fig.3. It has eight data inputs (DB0-DB7) which are buffered and then decoded with an 8-bit to 17-bit decoder. The 8-bit input provides 256 volume settings and these are decoded to a 17-bit code which provides logarithmic attenuation. When the 8-bit code is 0000 0000, the attenuation is 0dB. Each increase in count (0000 0001, 0000 0010, etc) increases the attenuation by 0.375dB.

Our circuit provides volume steps of 1.5dB, so we do not need 256 separate levels. Instead, only 60 steps are required. This is done by tying the DB0 and DB1 lines low (ie, to 0V) and varying only the DB2-DB7 lines.

Actually, the AD7112 provides two 17-bit D/A converters, one for each channel and both are controlled by the DB0 to DB7 inputs. This allows us to provide the balance facility so that the left and right channel gains can be individually adjusted.

Measured Performance

Signal-To-Noise Ratio ..... 110dB unweighted (20Hz-20kHz bandwidth)

Total Harmonic Distortion ..... <0.005% (20Hz-20kHz)

Frequency Response ..... DC to 50kHz (-3dB point)

Separation Between Channels ..... -89dB at 20kHz; -90dB at 10kHz; -106dB at 1kHz; -110dB at 100Hz (measured with undriven channel. input loaded with 1kΩ)

Attenuation accuracy (1kHz, 25°C) ..... <1dB to -54dB; <2dB to -66dB; <2.5dB to -88.5dB

Channel tracking accuracy ..... <±0.25dB

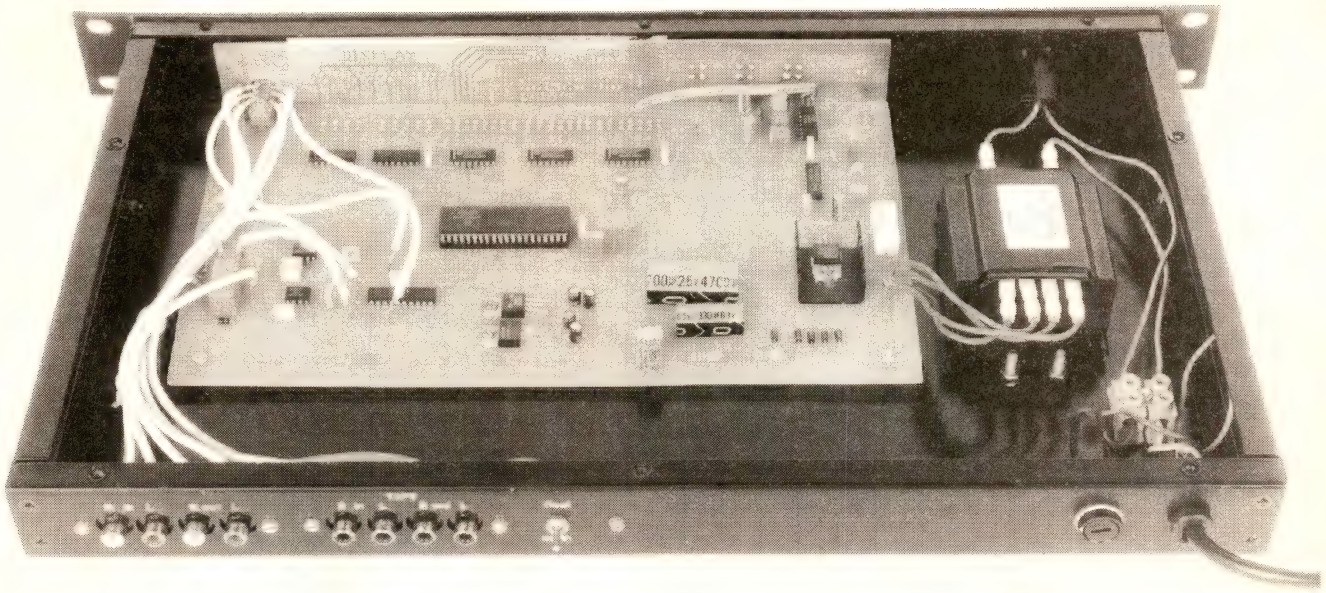
Maximum input signal ..... 8V RMS

Note: all performance measurements made with respect to 1V RMS input at 0dB attenuation

Circuit description

Now check out Fig.4, the main circuit diagram. This uses 11 ICs, several LED displays, three 3-terminal regulators, and various resistors, capacitors and diodes. IC1 is the microprocessor, IC2-IC6 are the LED display components, IC7-IC9 are the D/A converter and op amps, and IC10 and IC11 are for remote control reception and decoding.

IC1 is the microprocessor which controls the rest of the circuit. Its clock circuit is based on a 3.579545MHz crystal connected to pins 38 & 39,



Most of the parts are mounted on two PC boards which are soldered together at right angles. The display board (top) carries three 7-segment LED displays for volume level indication, a LED bargraph to indicate channel balance, an acknowledge LED, & three pushbutton control switches (Mute, Down & Up).

although the microprocessor actually operates at half this frequency; ie, at 1.78MHz.

The PA0-PA6 output lines of IC1 control IC2, IC3 & IC4, the 4511 BCD to 7-segment display drivers. These drive 7-segment LED displays via 330Ω limiting resistors. The display drivers are accessed by IC1 only when the volume level is to be changed.

Outputs PA7 and PB0-PB7 of IC1 control the balance display LEDs via Darlington transistor drivers IC5 & IC6.

The Down, Up and Mute switches on the front panel are monitored by the PD0, PD1 and IRQ (interrupt request) lines of IC1. Normally, these inputs are tied high via 10kΩ resistors to the +5V supply. When the Down switch is pressed, the PD0 input is pulled low and the IRQ input is also pulled low via diode D6. Similarly, the Up switch pulls PD1 low and pulls the IRQ line low via D7.

The Mute switch pulls both PD0 and PD1 low via diodes D9 and D10 and also pulls the IRQ line low via D8. A low IRQ level tells the microprocessor to "wake up" from its static idle mode and check the PD inputs.

Infrared signal decoding

The PD2-PD5 and PD7 lines of IC1 monitor the data outputs of infrared decoder IC11. When valid data is received by IC11, its Data output at pin 10 goes low, pulling the IRQ input of IC1 low via diode D11. This awakens IC1 and the decoded outputs of IC11 at pins 11-15 are now read by the microprocessor which acts accordingly. Pin 10 of IC11 also drives LED 1 (ACK), which indicates when an infrared signal is received.

IC11 decodes the signal from IC10, a Plessey SL486 infrared receiver. This IC has an infrared photodiode (IRD1) at its input to pick up signals from the remote control handpiece. The signals are amplified and filtered before they appear at the output (pin 9).

The capacitors connected to pins 2, 3, 5, 6 & 15 of IC1 roll off the frequency response to effectively filter out 100Hz signals. This is necessary to make the circuit immune to interference from 50Hz mains-powered lighting.

IC11 operates at 614kHz, a frequency set by ceramic resonator X2. This and the data rate set by links to pins 3 & 4 must match the settings inside the remote control handpiece (ie, the transmitter).

Digital to analog converter

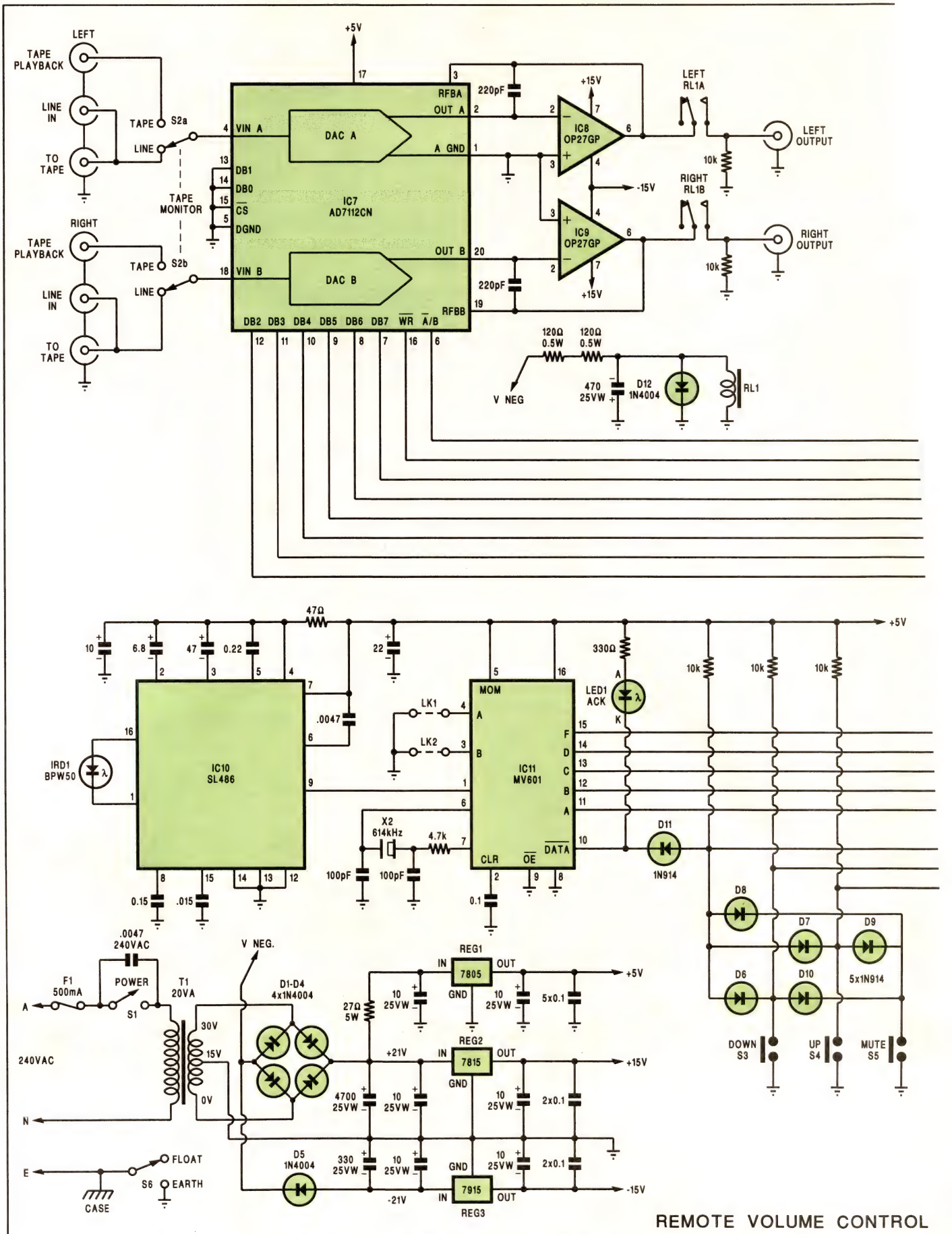
IC7, the AD7211 dual D/A converter, is driven by the PC0-PC7 output lines of IC1. The PC0-PC5 lines provide the data to IC7, while the PC6 and PC7 lines drive the WR and A/B inputs of IC7 to provide balance control. As noted above, although IC7 has eight data inputs, we are using only inputs DB2-DB7. The DB0 and DB1 inputs are simply tied to 0V.

The left and right channel inputs are fed via the tape monitor switch

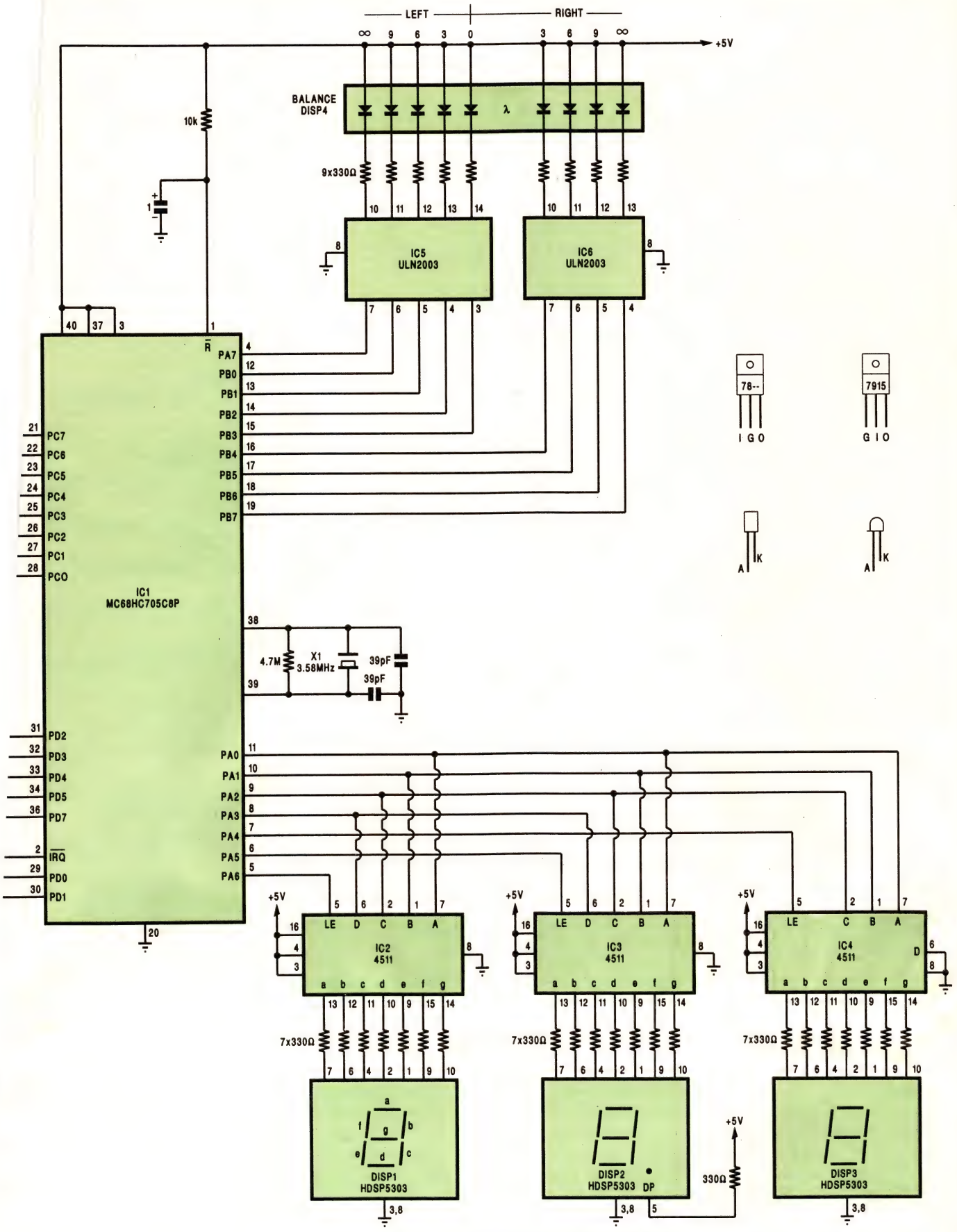
Main Features

- Infrared remote control of volume, balance and mute
- 88.5dB volume control range in 1.5dB steps
- 3-digit display of volume setting in dB
- 21dB mute
- Balance control in 1.5dB steps to -9dB, then fully off
- Microprocessor uses "static idle" mode to minimise noise
- Tape monitor loop
- Initial volume setting -48dB

Fig.4 (next page): the full circuit details for the Remote Volume Control. IC1 is the microprocessor & this controls D/A converter IC7. This in turn controls the gain of op amps IC8 & IC9 to vary the volume. IC1 also controls the LED displays via IC2-IC6. Instructions for the microprocessor are picked up infrared diode IRD1 & processed by IC10 & IC11.



REMOTE VOLUME CONTROL


LEFT
RIGHT
∞ 9 6 3 0 3 6 9 ∞
+5V
BALANCE
DISP4
10k
9x330Ω
IC5
ULN2003
IC6
ULN2003
78--
7915
I G O
G I O
IC1
MC68HC705C8P
PA7
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PC7
PC6
PC5
PC4
PC3
PC2
PC1
PCO
PD2
PD3
PD4
PD5
PD7
IRQ
PD0
PD1
PA0
PA1
PA2
PA3
PA4
PA5
PA6
4.7M
X1
3.58MHz
39pF
39pF
IC2
4511
IC3
4511
IC4
4511
LE D C B A
a b c d e f g
7x330Ω
DISP1
HDSP5303
DISP2
HDSP5303
DP
DISP3
HDSP5303
330Ω
ATTENUATION (dB)

PARTS LIST

Receiver
1 1-unit high rack mounting case
1 dark red Perspex sheet, 150 x 20 x 2.5mm
1 screen printed front panel, 480 x 44mm
1 self-adhesive rear panel label, 180 x 34mm
1 PC board, code 01305931, 283 x 161mm
1 PC board, code 01305932, 283 x 39mm
1 2 x 15VAC 20VA low profile transformer (Universal Electronics)
1 2AG panel mount fuse holder
1 500mA 2AG fuse
1 mains cord & plug
1 cord grip grommet
1 2-way mains terminal block
1 SPST mains switch (S1)
1 DPDT PC mount push on/off switch and knob (S2)
1 DPDT 12V relay (RL1, Altronics S-4150)
2 4-way RCA socket panels
3 snap action PC-mount switches (S3-S5)
1 SPDT toggle switch (S6)
2 40-pin machine IC sockets
4 rubber feet
1 heatsink, 25 x 30 x 12mm
1 2.5-metre length of shielded cable
1 300mm-length of twin shielded cable
1 750mm-length 0.8mm tinned copper wire
5 cable ties
31 PC stakes
4 5mm standoffs
2 solder lugs
1 Murata CSB624P 614kHz ceramic resonator (X2)
1 3.579545MHz parallel resonant crystal (X1)

Semiconductors
1 MC68HC705C8P programmed microprocessor (IC1 - available from SILICON CHIP)
3 4511 7-segment display drivers (IC2-IC4)
2 ULN2003 7-way Darlington drivers (IC5-IC6)
1 AD7112CN dual log D/A converter (IC7)
2 OP27G op amps (IC8,IC9)
1 SL486 IR receiver (IC10)
1 MV601 IR decoder (IC11)
1 7805 5V 3-terminal regulator (REG1)
1 7815 15V 3-terminal regulator (REG2)
1 7915 -15V 3-terminal regulator (REG3)
6 1N4004 1A rectifier diodes (D1-D5,D12)
6 1N914, 1N4148 diodes (D6-D1)
1 10-segment LED bargraph (DISP4, Altronics Cat. Z-0180)
3 HDSP 5303 0.3-inch common cathode LED displays (DISP1-DISP3)
1 3mm red LED (LED1)
1 BPW50 IR diode (IRD1)

Capacitors
1 4700µF 25VW PC electrolytic
1 470µF 25VW PC electrolytic
1 330µF 25VW PC electrolytic
1 47µF 16VW PC electrolytic
1 22µF 16VW PC electrolytic
6 10µF 25VW PC electrolytic
1 10µF 16VW PC electrolytic
1 6.8µF 16VW PC electrolytic
1 1µF 16VW PC electrolytic
1 0.22µF MKT polyester
1 0.15µF MKT polyester
9 0.1µF MKT polyester
1 0.015µF MKT polyester
1 .0047µF MKT polyester
1 .0047µF 250VAC polyester
2 220pF ceramic
2 100pF ceramic
2 39pF ceramic

Resistors (0.25W, 1%)
1 4.7MΩ
6 10kΩ
1 4.7k
32 330Ω
2 120Ω 0.5W
1 47Ω
1 27Ω 5W

Miscellaneous
Heatshrink tubing, screws, nuts, solder, etc.

Remote transmitter
1 remote control case (DSE Cat. ZA-4666)
10 chrome buttons for case (DSE Cat. ZA-3929)
1 PC board, code 01305933, 62 x 59mm
1 Dynamark front panel label, 73 x 63mm
1 9V battery & battery clip
5 click action momentary switches (S1-S5)
1 MV500 remote control transmitter (IC1)
1 MTP3055E N-channel Mosfet (Q1)
2 CQY89A IR LEDs (LED1,LED2)
1 Murata CSB614P 614kHz ceramic resonator
1 220µF 16VW PC electrolytic capacitor
2 100pF ceramic capacitors
1 10kΩ 0.25W 1% resistor
1 10Ω 0.25W 1% resistor
1 2.2Ω 0.25W 1% resistor

(S2a & S2b) to pins 4 & 18 of IC7 and its outputs at pins 2 & 20 connect to IC8 & IC9, respectively. The R_{FB} connections from pins 3 & 19 of IC7 set the gain of each op amp to -1, while the 220pF capacitors provide high frequency roll off to prevent instability.

Note that R_{FBa} and R_{FBb} inside IC7 each has a value of between 9.3kΩ and 15kΩ and these essentially match the series impedance of the laser-trimmed R-2R ladder in the DACs. Thus, the input resistance seen by each op amp is more or less constant, regardless of the signal level. This is important otherwise the noise performance of the op amp would be prejudiced.

In fact, the selection of the op amp in this application is quite critical. We needed a low noise amplifier with good slew rate capabilities plus high gain. Also required are low input bias currents and low input offset voltage. To meet these requirements, we have specified an OP27GP for both IC8 and IC9. A relay is used to isolate the left and right channel outputs of the op amps at power on and power off. This prevents any turn-on thumps from being fed through to the external power amplifiers.

Power supply

Power for the Remote Volume Control is derived from a mains trans-

ner with two 15VAC windings con-
cted in series to give 30VAC. This
ectified by diodes D1-D4 plus D5
d filtered by a 4700µF capacitor in
positive supply line and a 330µF
pacitor in the negative supply line.
ıe resulting ±21VDC rails are ap-
ied to 3-terminal regulators REG1,
EG2 and REG3 to obtain +5V, +15V
ıd -15V rails. The ±15V rails power
e op amps, while the +5V rail pow-
s the rest of the circuit.

The relay coil is supplied from the
egative rectified line at the junction
f diodes D3, D4 & D5 via two 120Ω
.5W resistors connected in series.
hese resistors reduce the supply to a
ıominal -12V.

Transmitter circuit

Fig.5 shows the circuit for the infrared remote control transmitter. It comprises a single IC, a ceramic resonator, two infrared LEDs, a Mosfet, several switches and a few resistors and capacitors.

IC1 is a Plessey MV500 chip which provides PPM (pulse position modulation) signals suitable for driving a transistor and infrared LEDs. In stand-by mode, the IC draws only 2µA which means that the circuit does not need an on/off switch.

The MV500 operates with an oscillator frequency of 614kHz as set by its ceramic resonator, so that it matches the conditions of IC11 in the Remote Volume Control.

Five pushbutton switches are connected between five of the row input pins (2-6) and the +9V supply via a single 10kΩ resistor. When a switch is pressed, a unique code for that switch is delivered from the output at pin 1 and this drives the gate of Mosfet Q1 via a 10Ω stopper resistor. Q1 then drives two infrared LEDs (LED 1 & LED 2) via a series 2.2Ω current limiting resistor. These two LEDs are driven very hard and are fed with 1.3A current pulses of 15µs duration (20% duty cycle). The 220µF capacitor across the 9V battery supplies the peak current to the LEDs.

Next month we shall present the assembly details and complete the construction of the Remote Volume Control. **SC**

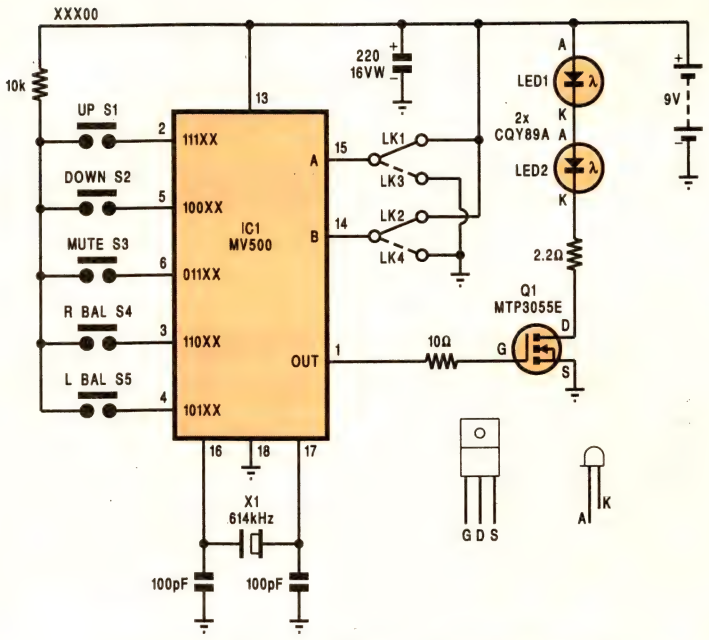
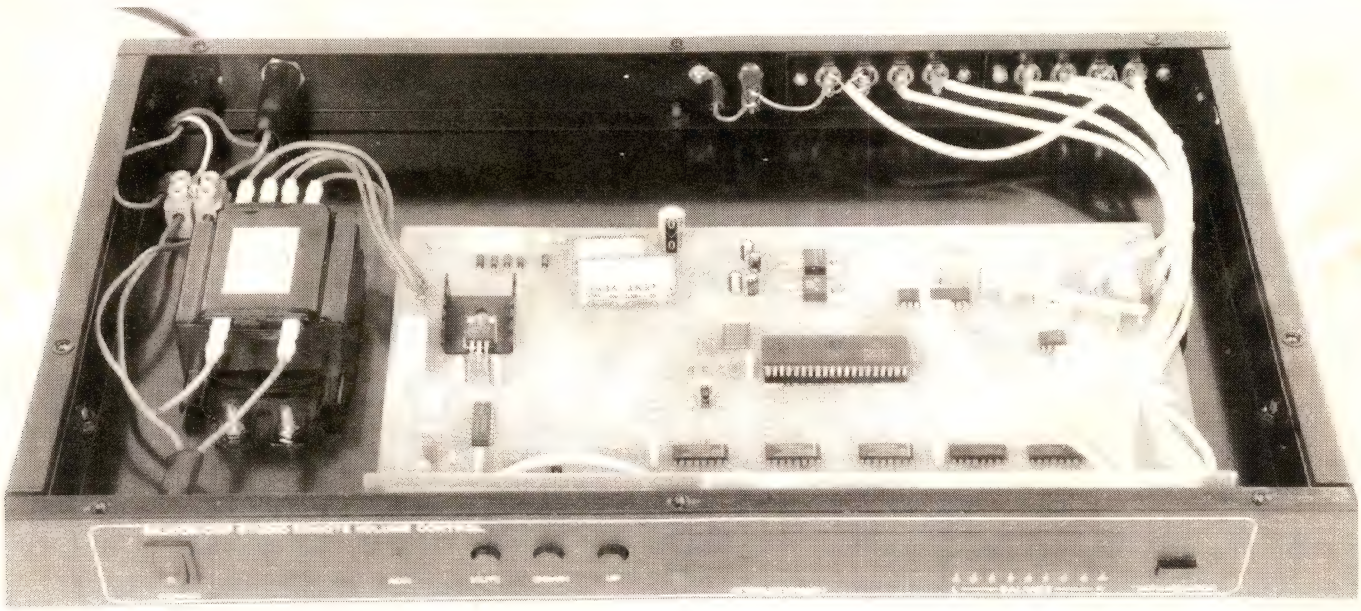


Fig.5: the transmitter circuit is based on an MV500 IC. Each time one of the switches is pressed, a unique code appears at the pin 1 output & this drives Q1 & two infrared LEDs.

Below: the Remote Volume Control can be installed in the tape monitor loop of an integrated stereo amplifier or between the preamplifier & power amplifier where separate units are used. It includes its own tape monitor loop so that you don't have to sacrifice this facility.



SERVICEMAN'S LOG

From little acorns, giant oak trees grow

This month's story is something like the acorn that grew. It grew into several stories within the main story, each important in it's own right. How best to present these without losing the main thread presented something of a problem, so bear with me if I digress along the way.

It all started with a routine phone call from a customer, complaining that his TV set was "on the blink". In more detail, the set involved was a National Panasonic TC-2690, a 63cm model using an M14 chassis. By "on the blink" he meant that it was completely dead, so I simply said "OK, bring it in".

I left the delivery job to him for a good reason. This set is housed in a large, double-ended, lowboy cabinet and, since he has a utility, it was no problem for him to transport it.

The M14 chassis is one of a whole series of "M" chassis; M9, M10, M11, etc, up to at least M16. I have dealt with several of these in the past but this was my first time for an M14. This chassis was produced between 1986 and 1988 and, apparently, was fitted to only a few models.

Anyway, the set was duly delivered. When I switched it on, I realised that the description "completely dead" was not strictly true. It sounded more as if it was dying, or being tortured to death, judging by the way the power supply was screaming.

Clearly, there was a serious overload of some kind, somewhere. It didn't take long to confirm my initial suspicion; the horizontal output transistor, a 2SD1632, was shot. No problem; I had one in stock.

This transistor comes in a plastic flat pack (TOP-66) encapsulation and is mounted on a heatsink on the side of the chassis. I fitted the replacement, taking care to use plenty of heatsink compound; an important precaution with such devices in heavy duty roles like this.

Another precaution was to make a routine check of two potential problem areas, based on past experience of the "M" chassis in general. One is the soldered joints to the horizontal output transformer pins, while the other concerns the horizontal driver transformer pins. Faulty joints in these areas are a frequent cause of failure of the horizontal output transistor.

But there were no problems here, so the set was plugged in and fired up. And everything worked fine. The only sour note – and it was nothing to do with the original failure – was that the picture tube seemed to be in rath poor condition; certainly much poor than I would have expected for a s only about five years old. But beyon making a note to draw the owner' attention to this – for my own protec tion as much as anything – there wa little I could do at this stage.

I refitted the set in its cabinet an ran it in the workshop for a couple o days. I then attempted to contact the owner but his work takes him out of town from time to time. I eventually contacted his wife, who said she would pass the message on. In the end, it was something like 10 days before he eventually turned up, during which time I had let the set run all day and every day in the workshop.

So that should have been that. But it wasn't, of course. Two days later he was on the phone complaining that the set – which he described in most colourful terms – was "... on the blink again".

There was no point in trying to determine whether it was displaying the same symptoms; it was "on the blink" and that was that. So I said "bring it in and I'll have another look at it".

In fact, it was quite some time before he brought it back; close to a month, in fact. Yes, I know that sounds strange but one encounters some strange types in this game. I know he has another set and apparently pressure of other things had intervened.

Anyway the set eventually turned up in the back of the ute and we manhandled it into the shop. And I realised that the lapse of time had not improved his opinion of the set, though I suspect that many of his thoughts were really meant for me, even though he stopped short of directing them at me.

In short, he was not a very happy customer.

Well, I wasn't very happy myself. A bouncing set is never a cause for celebration, if only because it usually

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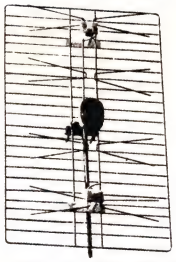

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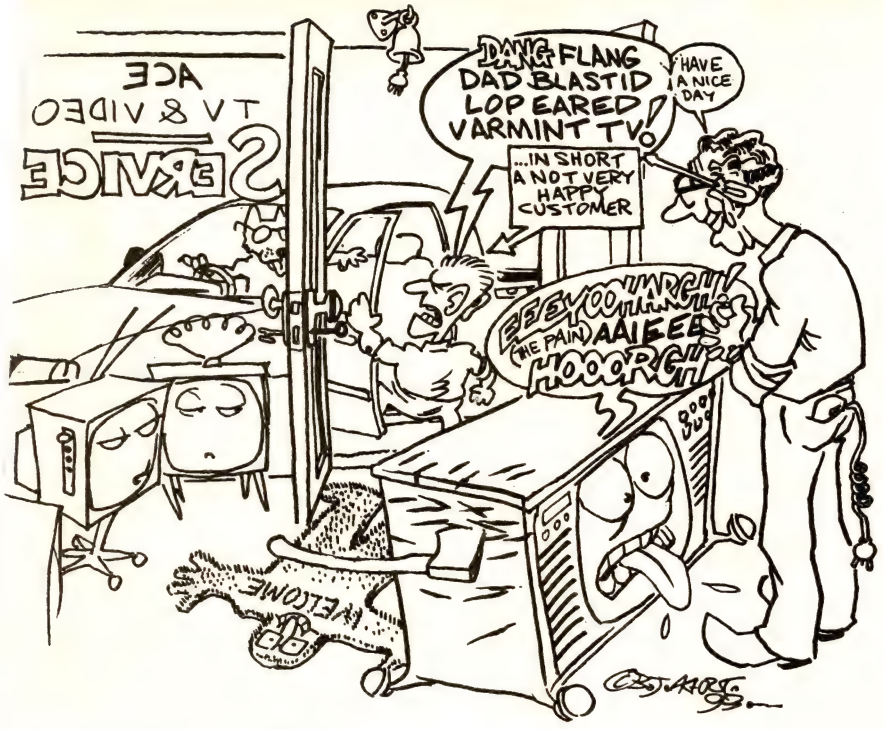

...THOUGH I SUSPECT THAT MANY OF HIS THOUGHTS WERE REALLY MEANT FOR ME

means more time spent on the job; time for which one can seldom charge. And when the customer is clearly in no mood to accept any explanation, the situation is doubly worrying.

Anyway, at the first opportunity, I pulled the back off, plugged the set in and switched on. There were more tortured screams from the power supply and another shot horizontal output transistor. If I was not happy before, I was even less happy now.

There was obviously no point in simply replacing the transistor. There was a "nasty" lurking somewhere in set, just waiting to pounce. Unless I could find it – and be sure I had found it – I dare not return the set to the customer.

At a servicing level, I obviously had to restore the set to working order before I could start searching for the fault. So a new transistor was fitted and the set came good, just as it had done before. I let it run but not before I had set up the CRO to monitor the collector and base waveforms of the transistor, both of which appeared to be quite normal at this stage (CRO points 17 and 16 respectively in the manual).

A diversion

Now, I'm going to digress here, because this is what actually happened. Having set things up as above, I had the urge to monitor everything for a while, in the hope that some clue might emerge. I knew it was long shot, because the set had previously behaved faultlessly for 10 days in the workshop. But I wanted some reason to hang around for an hour or so.

Looking at the picture on the screen, I was reminded of the poor picture tube performance. But was it the picture tube or could it be a circuit fault? And if it was a circuit fault, might it possibly have some bearing on the main problem. This was long shot but stranger things have happened.

A far more likely fault was low heater voltage, so that was the first thing to check. The heater is fed from a winding on the horizontal output transformer, via a 2.7Ω 2W resistor. And being AC at 15,625Hz, it cannot be measured with a conventional meter. I use one of the Fluke 87 series meters, which will measure this quite accurately.

And yes, there was something not quite right, But it wasn't a low voltage; instead, it was on the high side at 6.7V.

Why was this so? And to what extent was this responsible for the premature aging of the tube? More on this latter point in a moment. I backtracked to the 2.7Ω resistor (R523) and checked it. It was spot on and that left me in something of a quandary. I had no idea why the voltage was high, only that it was wrong.

But what could I do? Increasing the resistor to reduce the voltage would only make the performance worse. On the other hand, I could reduce the resistance and restore the tube performance but that would further shorten its life. Finally, I decided to take the easy way out and leave the setup as it was.

So just how significant was that over-voltage in the life of the tube? It doesn't sound much – a mere 6%, in fact – but all the indications are that it is quite serious. For a start, it must be remembered that the power dissipated by the heater increases at a greater rate than the voltage increase. If the heater resistance was constant, it would increase as the square of the heater voltage. The heater resistance is not constant, however, as it increases with temperature, but the tendency towards the square law remains.

At a more practical level, there is plenty of workshop evidence to sup-

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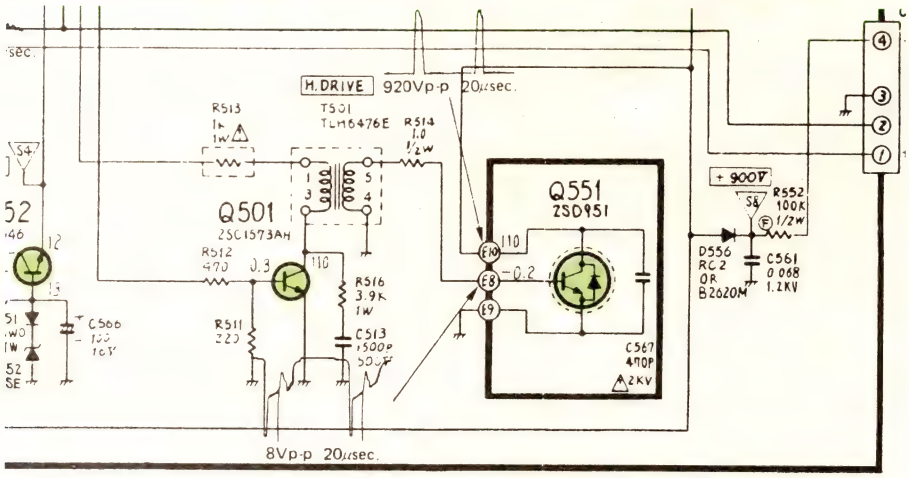

Fig.1: this is the horizontal output stage of the M11B chassis in the National TC-2656. The waveforms are similar to those of the M14 chassis as observed on the CRO but the indicated time scale could be misleading.

port the claim that it is serious. I have another set on the bench at the moment with a sick tube, which is also running with 6.7V on the heater. The set is still within its 3-year warranty, with about six months to go. It will probably be replaced but two and a half years is a ridiculously short life for any tube.

All of which has started me on a witch hunt. I have found at least half a dozen sets with varying degrees of over-voltage, ranging from 6.4V to the 6.7V already quoted. That raises the question as to what kind of tolerance is acceptable.

The best figure I can recall – and this is from the monochrome days – was issued by a local tube manufacturer and was to the effect that increasing the heater voltage from 6.3V to 6.5V could reduce the tube life to – repeat "to" – something like three or four years.

If I remember correctly, this warning was prompted by a particular model TV set which was gobbling up picture tubes like a kid let loose in a chocolate factory. Again this was due to a modest over-voltage but it was just too much for the heaters.

So what has this to do with the original fault? Well, it enabled me to rule out any connection between it and the poor tube performance and that was important. It also enabled me to hang around the set long enough for something to show, which it did. I suddenly realised that the picture was shrinking horizontally and that the transistor base waveform, as shown on the CRO, was changing.

The alarm bells started to ring. I'd seen that shrinking effect before somewhere and knew it meant that the transistor was about to be destroyed. I pulled the power plug and saved the transistor. More importantly, I now had a clue. What would cause a change in the waveform at the base of the 2SD1632? There wasn't much in driver circuit – just the driver tran tor (Q500), the driver transforn (T500), two resistors (R515 and R52 and two capacitors (C525 and C52

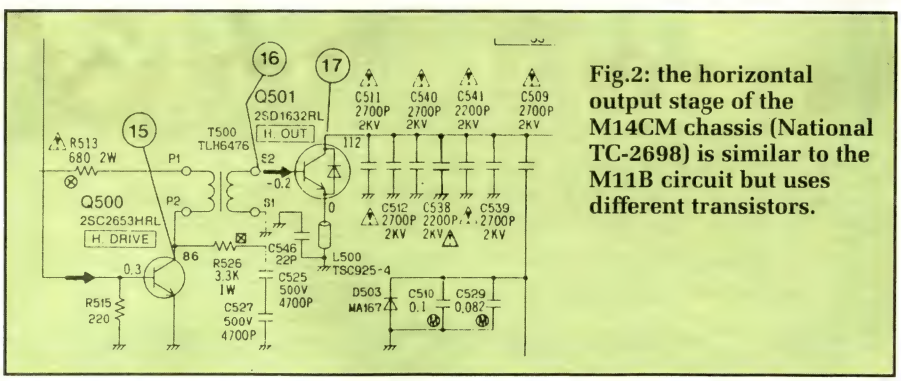

Fig.2: the horizontal output stage of the M14CM chassis (National TC-2698) is similar to the M11B circuit but uses different transistors.

The penny drops

The resistors and capacitors we easily checked and were spot on. Th left only the transistor and the tran former. And this was when the penr – which must have been teetering c the edge – suddenly dropped.

In my October 1990 notes, I d scribed a similar horizontal shrinkin problem in a National TC-2656 fitte with an M11B chassis. This chassi uses a similar driver circuit to th M14 and an identical driver trans former (designated TLH6476). Afte much travail, the fault was eventuall traced to this transformer.

Well, that was good enough for me. In a toss-up between the transformer and the transistor, history favoured the transformer. And, since I had one in stock and they are worth only a few dollars, I lost no time in fitting it.

I set things up again, with the CRO as before, and let the set run. And I let it run all day and every day for the next week. Then, with no sign of trouble, I fitted it back in the cabinet and let it run for several more days.

When it still didn't misbehave, I was cautiously optimistic that I had found the fault. I hadn't forgotten the last episode, when it ran for more than 10 days before it failed but I had to call a halt somewhere. It was time to contact the owner.

In fact there was a further delay; he didn't respond for some three weeks, during which time I flogged the set every minute that I could. By the time he did collect it, I was convinced that the fault really had been found.

The only charge I made was for the parts replaced, with no charge for labour. And I emphasised that he should contact me immediately if there was further trouble.

All that was several months ago and, at a recent check, all is well. So I consider the point proven. What's more, I sense that I am once again in his good books. He was quite lavish in his praise for the trouble I had taken, so all ended well.

Another case

But there is a good deal more than that to this story. I have had another

del TC-2698 with the same fault
:e then, this time with an M12
ssis. With the benefit of experi-
:e, this was an easy one but the
ure of the transformer failure re-
ins a mystery. I have taken the mat-
up with National's service depart-
nt but they are equally mystified;
/ three cases are the only ones that
ve been reported.

Even so, I find it hard to believe at my cases are the only ones that ive occurred. I suspect that there ay have been others but that the true ause has not been diagnosed. Just ow many of these sets have bounced id how the situation has been han-led, we shall probably never know.

More to the point, perhaps, is the xact nature of the failure and how it lamages the output transistor. What appens internally may well remain mystery but I have been trying to nake some waveform observations in an effort to explain why the transistor is destroyed.

Unfortunately, these observations have been only fleeting. As I have learned from bitter experience, when the circuit goes into its horizontal shrink mode, it's only seconds away from destroying the horizontal output transistor. And at around $20 a pop, I am not keen to sacrifice any more than I can help.

So I have not been able to do more than glance at the CRO and register that the waveform has changed. There is no time to make any measurements or records.

A normal waveform is shown on the accompanying M11 circuit, which is essentially the same for the M14 circuit, and an actual CRO pattern printout from an M14 chassis is also shown. This was made with a Hewlett-

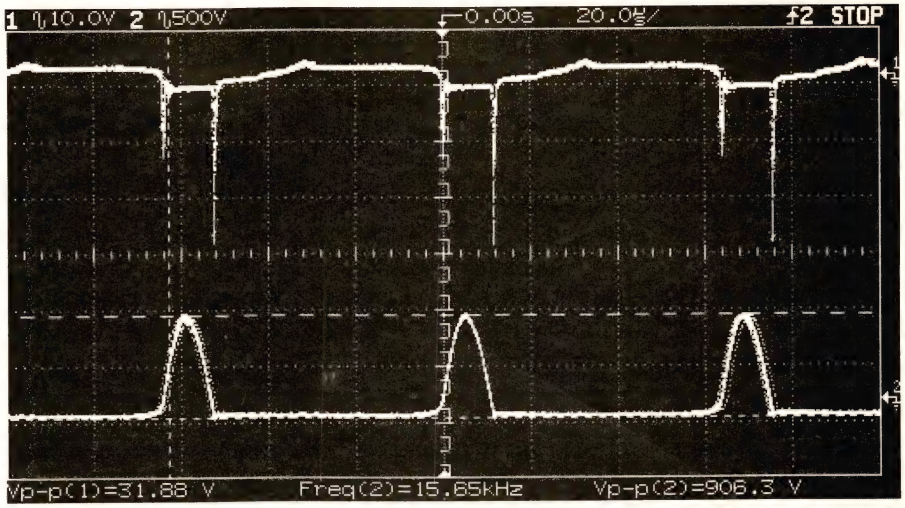

Fig.3: these waveforms are from the M14 output stage, as displayed on a Hewlett-Packard dual-channel CRO. The upper waveform is from the base of Q501 (10V/div & 20µs/div), while the lower waveform is from the collector (500V/div). The arrows on the extreme right indicate zero reference.

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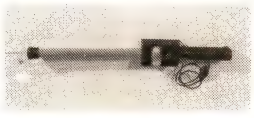

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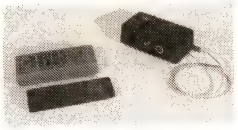

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Packard 2-channel digital CRO, model HP54600A, which has a facility (called ScopeLink) to feed the pattern into a computer and store it on disc. It can then be displayed on the computer screen or printed out. This is an extremely valuable facility which makes it possible to build up a store of waveforms that are not shown in a manual.

In fact, the dual scan CRO pattern is more meaningful than the separate waveforms on the circuit, because it presents both waveforms on the same timebase, making it much easier to relate the instantaneous behaviour of one with the other.

This pattern shows that the output transistor has a small positive voltage applied to it for most of the 64µs line period but is turned off for about 12µs at the beginning of the scan. This triggers the accompanying 900V collector pulse. The shape and amplitude of this pulse would be governed largely by the resonant characteristics of the horizontal output transformer.

This background information may help us answer the inevitable questions at some time in the future. In the meantime, we can only speculate as to why the transistor fails and a number of theories have been suggested by various colleagues.

Most have subsequently been discarded but there is one that seems reasonably creditable. This puts the blame on the spikes on the base waveform, which accompany the 12µs turn-off period, particularly the longer one of the two. This has an amplitude of around 32V in the CRO waveform shown.

This value should be within the base/emitter ratings of the output transistor but if the faulty transformer is generating much larger spikes, they may well exceed this rating. Significantly, the faulty transistors were broken down completely; base to emitter, base to collector and collector to emitter (the latter breakdown via the base).

And that's about all the comment I can offer at the moment. I realise that it is not a complete answer. And not every output transistor failure in this circuit will be due to this cause; most will be normal internal failures. But, if you encounter two failures in rapid succession, be warned.

End of story? Not quite. My discussion with the National service department raised another matter of concern regarding the 2SD1632 transistor. When I first described these transistor failures, first question the technician asked whether I had replaced the faulty t with the original type. I assured h that I had used a type 2SD1632 that didn't satisfy him. "Are you s it's an original replacement?"

I couldn't get the drift of his qu tion immediately and asked him clarify it. But I added that I wou have bought it from either his ov spare parts department or from a other spare parts dealer whom v both know to be thoroughly reliabl

Bodgie transistor

It was only then that he realise that I wasn't as up to date as he thougl I was. And he explained that ther was a bodgie version of this transistc going around, apparently from a Asian manufacturer.

The original 2SD1632 is made b Motorola and is stamped with its type number and the registered Motorol logo; ie, a stylised letter "M" in a rectangular frame.

The bodgie device also carries the type number and the Motorola logo and appears identical to the genuine device. On that basis there is no way to pick the bodgie from the real thing.

Fortunately, there is a way to pick it. There is a slight difference in the plastic moulding. With the package lying flat on the bench, check the space between the terminals. The bodgie device has a number of vertical ridges in this area, whereas the genuine device is quite smooth.

A quick check of my own stocks revealed that I have only the genuine version. In fact, I have not seen a bodgie one but I am assured they do exist. In fact they have turned up in small pockets in Queensland and Victoria, as well as NSW.

It is unlikely that a bodgie unit will be found in a set, unless the set has already been serviced in that section. But check existing stocks, or stocks being purchased. It is possible that some suppliers may be stocking them quite innocently.

And that really is the end of my trials and tribulations for this month. Unfortunately, I am not exactly the bearer of good tidings (I'm the kind who would have come to a sticky end in the good old "shoot the messenger" days) but at least readers should now be better informed about these chassis and the pitfalls to watch for. SC

JUST *HOW* MANY OF THESE SETS HAVE BOUNCED AND HOW THE SITUATION HAS BEEN HANDLED WE SHALL PROBABLY NEVER KNOW

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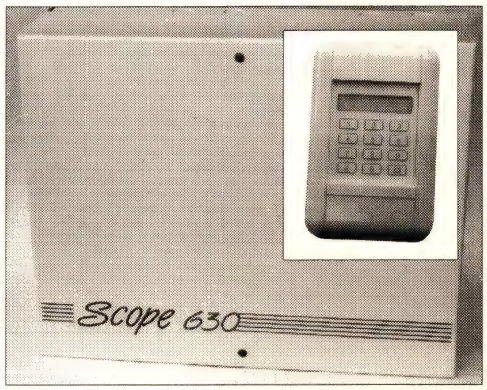

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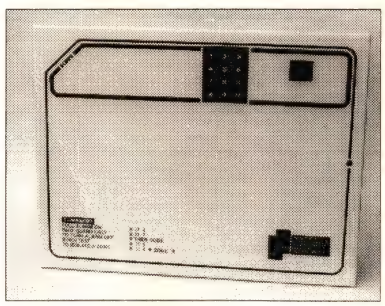

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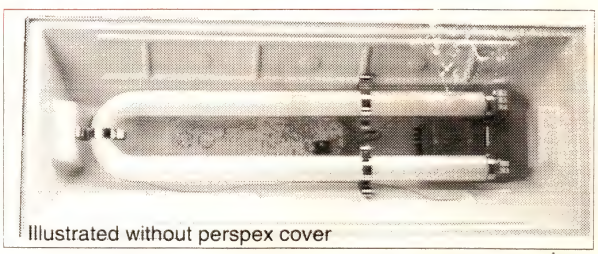
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ONLY $299

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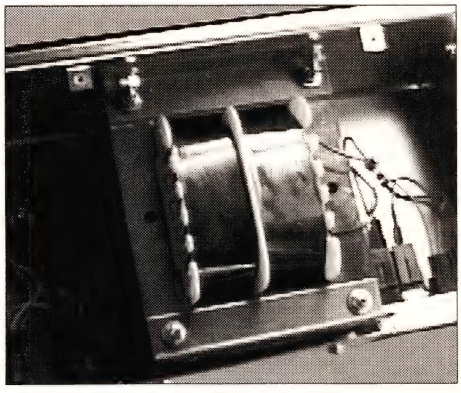


FULLY BUILT NiCad DISCHARGER

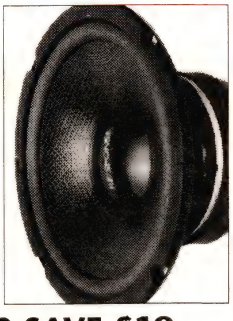
This discharger is a fully built and tested version of our popular KC-5120 kit. If you own a video camera, portable celluar phone, portable power drill, or any appliance that uses NiCad battery packs between 6 - 12V, you will need to discharge your battery packs before charging. This effectively eliminates the "memory effect' that NiCads develop after just a few charges. If you're serious about extending the life of your battery packs (and let's face it, most battery packs cost well over then single outlay of this discharger), this unit is essential. The built version comes fully calibrated, and mounted inside a robust die-cast case, black powdercoated, with a silkscreened front panel and fly leads, terminated with heavy duty alligator clips. Easy to operate, includes only one control, the battery voltage selector, complete with LED discharge/complete indicators. A truly robust unit, portable, and built to last.

Cat. XB-4980 **$49.95**

NEW FOR '93

RE/SPONSE - Hi Power Hi Quality Dual Impedance Speakers on Special This Month Only

Suitable for both Hi Fi audio and car speakers! For full specifications see 1993 catalogue or call into any Jaycar store.



6" RE/SPONSE

Power handling 80WRMS Cat. CW-2140

NORMALLY $75 NOW $65

SAVE $10

8" RE/SPONSE

Power handling 120WRMS Cat. CW-2142

NORMALLY $109 NOW $90 SAVE $19

12" RE/SPONSE

Power handling 200WRMS Cat. CW-2145

NORMALLY $199 NOW $179 SAVE $20

TWO NEW DC POWER PLUGS

1 - 1mm hole - suits Sanyo Walkmans, Diskmans, etc.

Cat. PP-0504 **$1.00**

2 - 3.1mm hole - suits JVC Walkmans, Diskmans, Organs, etc.

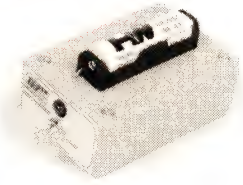
Cat. PP-0573 **$1.25**

For Wholesale Ph: (02) 743 5222

NEW KITS

SINGLE CELL NiCAD DISCHARGER KIT

Ref: Silicon Chip May 1993

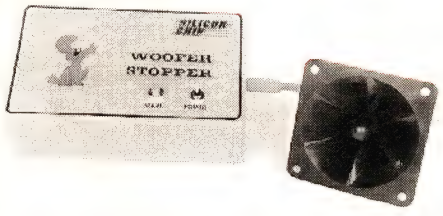


This discharger is unique in the sense that it requires no external power to operate, which makes it fully portable and extremely easy to use. Unlike our other popular discharger that suits packs from 6-12V (KC-5120), this unit has been designed to discharge AAA, AA, C or D cells. Housed in a tiny jiffy box, features include flashing LED discharge indicator, adjustabl discharge current; 20µA cell current once discharged; reverse polarit protection, and a cut-off at 1.1V. The Jaycar kit comes complete with PCB, case, all components, plus front panel label. Cell holder not included.

Cat. KC-5132 **$27.95**

'WOOFER STOPPER' KIT

Ref: Silicon Chip May 1993



Do you suffer noise pollution of the canine variety? Sick and tired of trying to sleep or even watch TV with the neighbours dog barking with reckless abandon? At the press of a button, this handy device emits a retaliatory high-level supersonic tone that lasts for about 9 minutes. If the device is used on a regular basis, the dog eventually realises that it is going to be reprimanded if it barks, and eventually ceases the problem. We cannot guarantee that it will work with every dog. There are several reasons for this, first some dogs are just plain stupid. Second, many older dogs are deaf, although older dogs are generally not problem barkers. The Jaycar kit includes the piezo tweeter, case, panel lable, hardware, PCB and all specified components.

Cat. KC-5133 **$59.50** Note: plugpack not included. Use MP-3006 – **$15.95**

OUTDOOR INFRA RED MOTION DETECTOR

This unit will automatically turn on two floodlights when someone walks within the detector range. Ideal security to protect loved ones and property. Detection range is 40 feet long by 60 feet wide. Lights will stay on for a minimum of 8 seconds and up to 15 minutes (adjustable). Works only at night. Globes not supplied but are standard portafloods available almost anywhere.

- 5 year guarantee on housing
- 2 year guarantee on sensor
- Comes complete with junction box
- Adjustable for 24 hour or dusk to dawn operation!
- Beware of inferior quality units.

Cat. LA-5132 **ONLY $39.95**

MOTOR/GEARBOX KIT

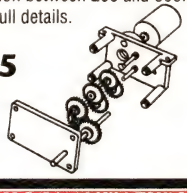
Motor, press fit brass cog, gearbox housing, 3mm x 110mm steel drive shaft, 2 intermediate shafts, 7 gearwheels and 6 nylon bushes. DC source 1.5V to 4.5V and consumption between 200 and 600mA depending on load. See catalogue for full details.

Cat. YG-2712

NORMALLY $21.95

NOW $19.95

SAVE $2



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OW COST DMM
3.5 DIGIT 12.5MM HIGH
ISPLAY LCD
TRANSISTOR TEST
DIODE TEST
10 AMP CURRENT
PLUG-IN LEADS

NEW FOR '93

ull feature meter with plug-in 4mm probes AND transistor ester for under $35!!!
his is the ideal first multimeter, and will give years of aithfull service.

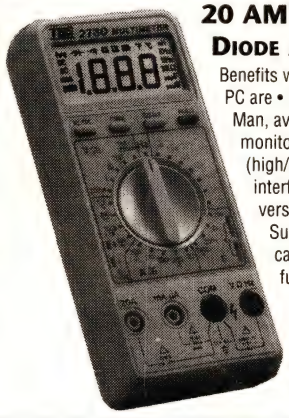
SPECIFICATIONS

DC Voltage 200mV res 100µV ±0.25%, 2000mV res 1mV ±0.5%, 20V res 10mV ±0.5%, 200V res 100mV ±0.5%, 1000V res 1V ±0.5%. Max input 1000V DC **DC Amps** 200µA res 100nA ±1%, 2000µA res 1µA ±1%, 20mA res 10µA ±1%, 200mA res 100µA ±1.2%, 10A res 10mA ±2%. Overload protected mA input 2A fuse **AC Volts** 200V res 100mV ±1.2%, 750V res 1V ±1.2% max input 750V rms input impedance 1Meg **Res** 200Ω res 100mΩ ±0.8%, 2000Ω res 1Ω ±0.8%, 20k res 10Ω ±0.8%, 200k res 100Ω ±0.8%, 2000k res 1k ±1% **Diode Test** measures forward resistance of a semiconductor junction in kΩ at test current 1.5mA max. **Battery Life** 100 hrs carbon, 200 hrs alkaline - 9V (battery included)

Cat. QM-1500 **$34.95**

TES DIGITAL MULTIMETER (RS-232 WINDOWS VERSION)

• Computer Interface • Temperature • Capacitance • Frequency 20MHz • 3.5 Digit • 20 AMP Current • Data Hold • Diode and Continuity



Benefits when your DMM can communicate with a PC are • Digital/Analog readout • Recorder • Max, Man, averaging zero calculation • Long time monitoring (Field/Lab) • Production line QC (high/low) • Printer to print out data • RS-232 interface to talk to PC (Windows/DOS versions)

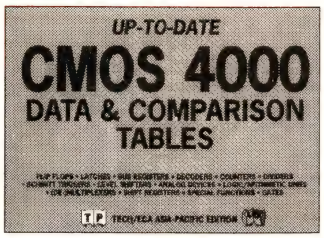
Supplied with test leads, RS-232 connecting cable and software disc, battery and spare fuse.

Cat QM-1440 **$219.50**

NEW FOR '93

5 NEW BOOKS FROM JAYCAR

No.1 UP-TO-DATE CMOS 4000 DATA AND COMPARISON TABLE - 1993 EDITION

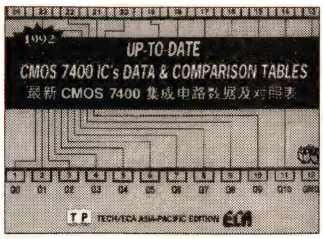


It's finally out! The completely revised new edition of "CMOS 4000" including the logic families 40xx, 45xx, 47xx and 40xxx. This book contains over 300 useful pages of data incorporating basic explanatory data regarding the CMOS 4000 series and the list of manufacturers; characteristic data for different supply voltages, pin configurations and partial internal circuiting, as well as the static and dynamic logic behaviour of the circuit. It also presents the dimensional outline drawings of the IC and much more. This book is a must for designers and experimenters.

NEW FOR '93

Cat. BM-4567 **ONLY $19.95**

No.2 UP-TO-DATE CMOS 7400 IC'S DATA AND COMPARISON TABLES

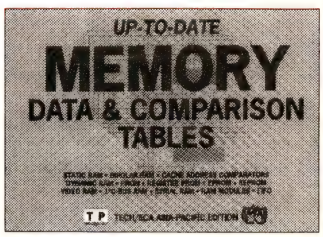


This book contains over 260 pages of essential information for the technician and the hobbyist. Includes: A list of manufacturers; combining all salient data such as abbreviations, data comparisons, pin assignments, logic tables and where necessary - notes, all on a single page. The "CMOS 7400's" tabulation should become an indispensible tool in your data collections.

Cat. BM-4566 **ONLY $19.95**

NEW FOR '93

No.3 UP-TO-DATE MEMORY DATA AND COMPARISON TABLE - 1993 EDITION



This book is a great help in finding a suitable type device since it is itemised according to type, capacity and pin no. of the memory device, i.e. it provides the user with an overview of the many memory devices listed. All data important to the user such as memory organisation, case styles, technology, manufacturers, logic and programming tables as well as the connection diagram. Data includes dynamic RAM, static RAM, RAM modules, EPROMs, EEPROMs, these are just to name a few. This book contains over 400 pages and is very useful to anyone in the computer technical field.

Cat. BM-4565 **ONLY $19.95**

NEW FOR '93

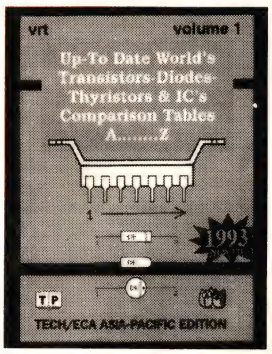
No.4 "THE PROGRAMMER'S TECHNICAL REFERENCE" MS-DOS, IBM PC AND COMPATIBLES

This book is unique in the history of the PC. It simply is impossible to find the information within these covers elsewhere, much is "undocumented" some is what the manufacturers would prefer you didn't know! The coverage of data is vast, and includes: the ROM BIOS; DOS interrupts and function calls; device drivers; enhanced and expanded memory specifications; conversion between MS-DOS and other operating systems; MicroSoft Windows application program interface; network interfacing; mouse programming; video sub systems. You would normally expect to pay well over $50 for all this information in one book.

Cat. BM-2482 **ONLY $24.95**

NEW FOR '93

No.5 UP-TO-DATE WORLD'S TRANSISTORS - DIODES - THYRISTORS AND IC's COMPARISON TABLES

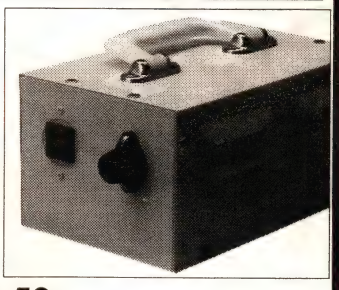


A - Z 1993 EDITION VOL 1

Volume one lists comparison tables of nearly 28,000 types of components. Over 80,000 comparison and equivalent types given. Lists semiconductors with prefixes from A to Z. Softcover, 1095 pages 110 x 150 x 43(thick)mm

Cat. BM-4580 **ONLY $19.95**

STEPDOWN TRANSFORMERS AT AN AFFORDABLE PRICE



Manufactured in Australia from heavy guage steel, painted with white powder epoxy paint. Supplied with a carry handle, rubber feet, fuse and 3 pin output (115V) socket with earth. Built and designed to Australian standards AS3108. Approval No N11529. There are two sizes available.

1, 240V -115V @ 250 watts Size 240(L) x 152(W) x 125(H)mm. Cat. MF-1094 **$179.50**

2. 240V - 115V @ 65 watts Size 185(L) x 140(W) x 90(H)mm Cat. MF-1092 **ONLY $99.50**

NEW FOR '93

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR'S DISCONTINUED PRODUCT SELLOUT

MANY ITEMS BELOW COST!

Stock is limited, there may not be all items in all stores. If your nearest Jaycar Showroom has sold out of the item you want to purchase, you can phone **(02) 743 6144** and they will advise which stores had that particular product in stock at the beginning of the sale. You can also phone around yourself, or you can place an order with our Mail Order Department on **(02) 743 6144**, using a credit card and we will do the finding for you and send you the goods (plus post and packing). For full specifications and descriptions on the products listed below check our 1992 catalogue. Be quick, stock is limited and won't last.

Cat. No	Description	WAS	NOW
AR-1470	Answ Machine/Data Cass 60 min	$1.95	$1.00
AR-1482	20 Cass Vinyl Carry Case	$7.95	$3.95
AA-2025	PTT Switch for Aviation Headset	$29.95	$17.95
AS-3190	Electronic Piezo Push Bike Horn	$12.95	$4.00
AX-3517	6" Black metal Speaker Grille	$5.00	$2.95
BS-0512	IC OP-Amp Cookbook 3rd Edition	$49.95	$34.95
BS-0518	CMOS Cookbook	$49.95	$34.95
BS-0520	TTL Cookbook	$49.95	$34.95
BS-0740	IBM Personal Upgrade Guide	$49.95	$34.95
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BP-1210	Electronics Build and Learn Book	$17.95	$7.95
BP-1220	Electronic Power Supply Handbook	$19.95	$7.95
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BP-1230	Home Security Elect Projects Book	$19.95	$12.95
BT-1336	Design & Build Elect Power Supplies	$34.95	$25.00
BT-1338	Build Your Own Test Equip Book	$34.95	$25.00
BM-2116	386 Computer Handbook	$29.95	$14.95
BM-2417	Understanding Automation Systems	$12.95	$9.95
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CW-2152	10" Subwoofer 120 Watt RMS	$99.00	$69.00
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DC-3080	CB Quick Disconnect Ant Fitting	$13.95	$5.00
DC-4000	Cellular Car Phone Antenna	$49.95	$29.95
HP-0504	4mmx12mm Cap Screw pkt 10	$3.25	$1.75
HP-0506	4mmx12mm Cheese Hd Bolt pkt 20	$3.25	$1.00
HB-5002	Diecast Box 110x63x30mm	$9.95	$6.95
HB-5020	Diecast Box 119x94x55mm	$15.95	$11.95
HB-5459	Aluminium Box 150x55x100mm	$12.50	$7.50
HB-5935	Plastic Box Front & Rear Metal Panel	$28.95	$15.00
HB-6051	Sm Hi-qual Plastic Box 160x80x44	$14.50	$7.00
HB-6052	Med Hi-qual Plastic Box 160x80x60	$15.50	$8.00
HB-6056	Lge Hi-qual Plastic Box 197x110x86	$18.95	$12.00
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KA-1696	Kit - Temp Probe for Multimeters	$19.95	$10.00
KA-1728	Kit - VHF Powermatch	$52.50	$25.00
KC-5021	Kit - Protector for Car Alarm	$79.50	$39.50
KC-5058	Kit - 19 range Analogue Multimeter	$38.95	$25.00
KC-5071	Kit - 6/12 volt SLA Battery Charger	$55.00	$30.00
KC-5075	Kit - Capacitance Meter 1pF/9999µF	$99.50	$69.50
KC-5078	Kit - PSU Load Protection	$17.95	$7.00
KC-5082	Kit - DC Offset for DMM	$39.95	$20.00
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KC-5114	Kit - VHF TV Transmitter	$99.95	$50.00
LT-3175	Gutter Grip TV Antenna VHF/UHF	$55.00	$35.00
LA-5012	PIR Doorway Mini Alarm	$49.95	$25.00
LA-5018	Pulse Count PIR Detector	$79.95	$50.00
LA-5020	Hall Lens for above	$4.95	$2.00
LA-5022	PIR Pulse Count Intel Detector	$99.00	$60.00
LA-5023	Hall Lens for above	$4.95	$2.00
LA-5028	Ceiling PIR National 360° Span	$99.00	$39.00
LA-5030	Long Range PIR National Brand	$99.00	$39.00
LA-5032	Wide Range PIR National Brand	$129	$49.00
LA-5130	Night Security Sensor PIR Outdoor	$99.00	$59.00
LA-5160	Alarm Digital Access Keypad	$69.50	$38.00
LA-8922	Hyper Car Interior Detector	$99.00	$65.00
MF-1002	PCB Trans 240/6V + 6V AC 7VA	$13.50	$7.00
MS-4028	8 Outlet quality Mains Filter	$249	$160.00
MT-4720	Transformer 10k-10k Line	$39.95	$20.00
MI-5000	12 Volt DC - 240V AC 300W Inverter	$399	$295.00
MI-5030	12 Volt DC - 240V AC 100W Inverter	$189	$100.00
ME-6002	Earth Stake for Electric Fence	$14.95	$2.00
ME-6010	High Efficiency Electric Fence	$139.50	$75.00
NA-1030	Screen Care - Computer Monitor Cleaner	$10.95	$2.00
NA-1032	Compuclean - Computer Cleaner	$7.50	$3.50
PS-0619	Wire Coupler Rapid Solderless	$3.50	$1.00
PP-0670	Twinax Coax Male Plug	$9.95	$3.00
PS-0672	Twinax Coax Chassis Socket	$11.95	$3.00
PL-0853	D25 Female to Centronics Lead 1.8m	$9.95	$5.00
PL-0878	Centronics Plug - 34 way IDC Cable	$5.00	$1.00
PP-0967	IDC Header 26 way Right Angle	$2.25	$1.00
PI-6522	24 pin ZIF Socket	$24.95	$5.00
PI-6541	Molex Pins - pack of 100	$2.95	$1.50
QT-2250	Built Transistor-Continuity Tester	$22.95	$12.00
QT-2320	Built AC Millivoltmeter	$199	$125.00
QT-2330	1.26GHz Digital Hand-Held Freq. Counter	$299	$160.00
QM-3800	Magnifing Glass Economy	$0.99	$0.50
QP-5504	Lascar DPM500 3.5 Digit Disp LCD	$85.00	$40.00
QP-5510	Lascar DPM200 3.5 Digit Disp LCD	$89.95	$40.00
QP-5516	Lascar DPM600 3.5 Digit Disp LCD	$89.95	$40.00
QM-7200	Pocket Personal Databank/Calculator	$34.95	$20.00
QM-7212	World Time Travellers Clock	$26.95	$12.00
QM-7220	Pedometer & Clock	$19.95	$9.00
RN-3460	A25 Glass Thermistor	$3.00	$1.00
RG-5252	0.033mF/250V AC Mains Capacitor	$0.30	$0.20
RQ-5295	16.257MHz Crystal	$2.95	$0.20
RU-6761	1000mF 63V RP PC Electro Cap	$1.00	$0.50
RU-6770	1000mF 63V LY PC Pin Electro Cap	$1.00	$0.50
RU-6771	2200mF 35V LY PC Pin Electro Cap	$2.00	$0.50
ST-0598	Swann Series 475 SPST 12V 10A Illum Toggle Sw	$2.95	$1.50
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SK-0971	DPDT 240V 16A illum White Switch	$3.95	$1.00
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SF-2223	250mA 3AG Slow Blow Fuse	$1.40	$0.20
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SB-2310	Cellular Bat Pack Motorola MicroTac	$79.95	$40.00
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ST-3035	Quartz Halogen Spotlight	$59.95	$25.00
SY-4002	Cradle Relay Socket 2 Change Over	$1.95	$0.20
SY-4021	Octal Relay Socket	$6.95	$4.50
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TS-1426	1mm Tip to suit Portasol Pro Iron	$16.95	$10.00
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TS-1432	2mm Tip to suit Nimrod Gas Iron	$6.95	$5.00
TS-1436	Torch Tip to suit Nimrod Gas Iron	$12.95	$8.00
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TH-1941	Olfa Panel Blades 5mm pkt 6	$3.95	$2.50
WC-1095	CB Patch Lead, PL259 to PL259 50cm	$7.95	$3.00
WB-1501	White Single Shielded Quality Cable per metre	$0.40	$0.10
WB-1525	2 Core Pro Quality Microphone Cable per metre	$3.95	$2.00
WB-1530	Single Screen Low Capacitance Cable per metre	$2.50	$1.00
WB-1610	10 Pair Telephone Cable per metre	$2.50	$1.50
WB-2001	75 ohm White Light Duty Coax Cable per metre	$0.80	$0.40
WB-2002	75 ohm Brown Air Spaced Coax Cable per metre	$0.60	$0.25
WB-2005	75 ohm White Coax Heavy Duty Cable per metre	$1.00	$0.40
WW-4316	Red 3.5" Wire Wrap Wire pack 100	$5.95	$2.00
XC-0104	Alarm Clock Movement	$12.95	$5.95
XC-4721	3.5" DSDD Verbatim Disks box 10	$29.95	$17.00
XC-4726	5.24" DSDD Verbatim Disks box 10	$24.95	$13.00
YT-7038	Telephone Clock Radio AM/FM Radio	$99.00	$60.00
YT-7040	10 Memory Telephone Ans System	$249	$170.00
YT-7060	Slimline Telephone with Base	$49.95	$30.00
YT-7068	GME Cordless Phone	$279	$180.00
ZR-1130	BR100 Diode	$0.95	$0.40
ZD-1860	4 Digit LED Display COM6121	$2.95	$1.00
ZT-2205	BF494 NPN RF Transistor	$1.95	$0.40
ZT-2215	BFR84 N Channel MOSFET	$4.65	$2.00
ZT-2228	ASI461/BFQ10 Dual N Channel JFET	$19.95	$7.95
ZT-2330	2N3645 PNP Transistor	$0.65	$0.20
ZL-3062	TL062 JFET OP Amp	$2.95	$0.60
ZL-3394	LM394CH Matched pair	$3.95	$1.00
ZL-3834	CA3100E Wideband OP Amp	$4.95	$1.00
ZL-3840	LM3140/CA3140 OP Amp	$1.95	$0.50
ZC-4022	4022 Divide by 8 Counter/Divider	$1.95	$0.20
ZC-4025	4025 Triple Input NOR Gate	$1.50	$0.20
ZC-4042	4042 Quad Locked D Latch	$1.20	$0.40
ZC-4078	4078 8 Input NOR Gate	$0.80	$0.30
ZC-4426	4426 Decade Counter 7 Seg Output	$2.95	$0.80
ZC-4538	4538 Dual Prec Mono Multivibrator	$2.50	$0.40
ZC-4896	74HC4075 14 Pin CMOS	$0.95	$0.20
ZC-4902	74C02 Quad 2 Input NOR Gate	$0.95	$0.20
ZS-5243	74LS243 Quad BUS Transceiver	$2.95	$0.20
ZS-5273	74LS273 Octal Trans. Tri-State latch	$2.95	$0.40
ZS-5352	74LS352 Inverting LS353	$1.50	$0.10
ZS-5367	74LS367 Hex Buffer 2/4 Bit	$1.25	$0.20
ZZ-8430	6116 2k x 8 CMOS Static RAM	$6.95	$2.00
ZZ-8437	1M10 1 Meg D RAM 100nS	$15.95	$7.95
ZZ-8440	6264 28 Pin RAM	$15.00	$2.00
ZZ-8450	2708 EPROM	$14.95	$8.00
ZK-8832	XR2240 Program Timer/Counter	$4.25	$1.00

DON'T WASTE TIME - IF YOU WANT SOMETHING IN OUR DISCOUNTED LIST ACT NOW!

JAYCAR ELECTRONICS

SCOPE 20 WATT IRON SPECIAL

The Scope Commodore is a 240 volt mains powered, professional 20 watt soldering iron. The features include an air cooled finger grip, which is ideal for continuous use. The tip and barrel are earthed for added safety. Replacement tip available - long life 2mm tip Cat. TS-1492 $6.95
Cat. TS-1490

NORMALLY $34.95 MAY SPECIAL
$29.95 SAVE $5

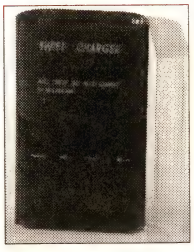
SCOPE

12 VOLT LIGHTWEIGHT SOLDERING IRON BARGAIN

This extremely lightweight iron is supplied with a length of cord and a cigarette lighter plug. Simply plug this into your car cigarette lighter socket for instant use, or remove the plug on the iron and connect it to a 12 volt power supply. Will operate on both AC and DC current from 12 volts to 24 volts. Tip is part of the iron, but should last for many, many hours of work!
Cat. TS-1475

NORMALLY $11.50
NOW ONLY $7.50
SAVE $4

LOW VOLTAGE NICAD BATTERY CHARGERS 9 VOLT FAST CHARGER



This unit will charge 4 x AA or AAA NiCads in about 1/2 the time of normal chargers. It requires 9 volts which can be supplied by numerous means, eg. 240V to 9V DC 300mA (MP3005 $16.95) adaptor (use one from your calculator or walkman, etc), via a DC-DC converter (MP3014 $16.95) from your car cigarette lighter socket, you could even use a solar panel. Voltage input is a 2.1mm DC socket.

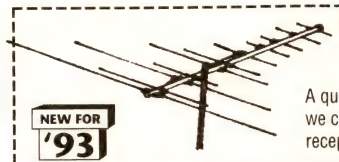
Features:
• Fast charge • Accepts AA and/or AAA batteries • Auto cut off when batteries charged, indicated by flashing LEDs • Low cost by utilising existing plug packs, etc. • Small size 125(L) x 73(D) x 36(H)mm.
Cat MB-3512

NORMALLY $12.95
NOW $9.95 SAVE $3

DELUXE REGULATED CAR CONVERTOR 12V TO 1.5 / 3 / 4.5 / 6 / 7.5 / 9 / 12V @ 800MA

A better quality IC regulated voltage adaptor designed to operate electronic equipment from your car cigarette lighter. Ideal for equipment like CD players, LCD colour TV's, etc., that requires quality regulated DC. Supplied with six different plugs to suit most equipment (DC plugs - 1 x 3mm, 1.4 x 5mm, 2.1 x 5mm, 2.5 x 5.5mm, 1.5 x 5.5mm, and a 3.5 mini plug). Includes a LED monitor, short circuit protection and replaceable fuse for overload protection. Note: 12V output is NOT regulated.
Cat. MP-3013 **$19.95**

BARGAIN UHF/VHF OUTDOOR ANTENNA



NEW FOR '93

PRICE BREAKTHROUGH!!

A quality UHF/VHF antenna for under $40? That's right, due to jaycars' buying power we can now offer this ideal suburban antenna which is suitable for good to medium reception areas. receives UHF channels 28 to 36 (Band 4) and VHF channels 0-11. Sturdy construction designed for the do-it-yourself user. Boom length 1.2m Cat. LT-3140 **$39.95**

MICROWAVE OVEN LEAK DETECTOR

NEW FOR '93

Microwave ovens may leak very harmful high energy which will affect your health. It usually results from wear and tear on the door components, including the hinges and the seals on the door.
This unit will detect these leakages. By placing the front lens of the leak detector against the seam of the oven (whilst the ovens on) and moving it slowly along the line of the seam. If the meter points to the green, there is little leakage, but if it points to the red a dangerous leak exists. Have your oven checked and repaired at once by an authorized dealer. These detectors normally sell from $20 to $25. We have them available at about half that.
Cat. QM-7260 **$12.95**

CORDLESS TELEPHONE BATTERIES

Don't pay huge amounts of money for your replacement NiCad batteries for your cordless telephones when they die! Jaycar now stocks the four most used battery combinations. Top quality batteries supplied. New lower prices also!

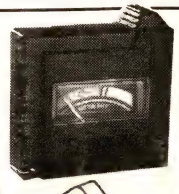
Type 1 • Nominal voltage 4.8V • Nominal capacity 250mAH • Used in the ATD MP200 and MP250 telephones
Cat SB-2472 **WAS $22.95 $12.95**

Type 2
• Nominal voltage 3.6V • Nominal capacity 280mAH
Cat SB-2474 **WAS $16.95 $9.95**

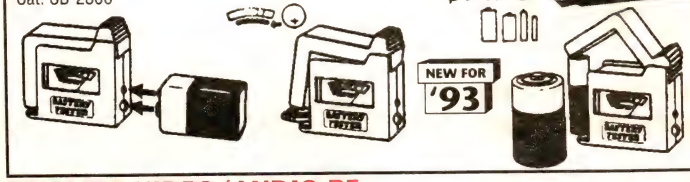
Type 3
• Nominal voltage 4.8V • Nominal capacity 250mAH
Cat SB-2475 **WAS $32.95**
$19.95

Type 4 NEW FOR '93
• Nominal voltage 3.6V • Nominal capacity 280mAH
• Used in GME Electrophone plus others
Cat SB-2473 **$12.95**

BATTERY TESTER

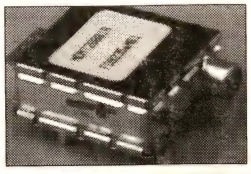


This compact unit will test all battery types from 9V and 1.5 volt to button batteries. The meter will advise if the battery needs replacing, or in the case of NiCads recharging. Loads up battery to determine charge. Incredibly compact - measures only 53 x 50 x 18mm
Cat. SB-2300 **$9.95**



NEW FOR '93

QUALITY VIDEO/AUDIO RF MODULATOR



VHF unit switchable to Australian channle 3 or 4. Audio is at correct subcarrier frequency and output frequency is stable with strong signal. Full specs supplied with unit.
Cat. LM-3848 **$22.95**

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Call Mark Harris or Bruce Routley NOW on (02) 743 5222

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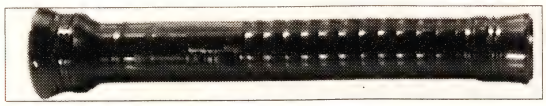
THE $2 POCKET TORCH

We have sold thousands of machined aircraft grade aluminium flashlights for $9.95. This torch is made of polished steel and gives out a very reasonable light. It's ideal for keeping in the glovebox, toolbox, handbag and around the house in case of emergencies. And at $2 you can certainly afford to. Uses 2 AA batteries. Pkt 4 Cat. SB-2330 $1.60.

Cat. ST-3010 **ONLY $2 each**

BARGAIN NEW FOR '93



MOTOROLA J FET BARGAIN

Type J309. Package TO-92, high frequency N-channel J FET.
Brief specs: ReVts (mmho) min -12+, f (MHz) 100, ReYos (µmho) max 250+, f (MHz) 100, Clas (pF) max 7.5, Cres (pF) max 2.5, HF (dB) max 1.5+, RG=1k f (MHz) 100, (V) min 25.
Cat. ZT-2380

WORTH OVER $3 ea
pkt 50 for $10

STETHOSCOPE

Yes, that's right, Jaycar now stocks a high quality stethoscope!! Its acoustic response is remarkable. Unlimited uses, listen to your heart!! Use with our blood pressure meter, even listen for nasty knocks in your cars engine. Japanese made.

Cat. QM-7255 **$19.95**

FERRITE ROD REDUCED

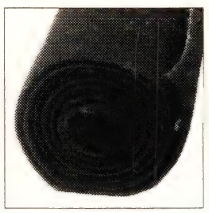
New size 100mm long x 9mm diameter. Cat. LF-1010

NEW LOW PRICE $1.00 ea

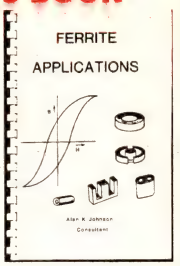
SPEAKER CARPET

At last. Now you can buy the black carpet that is on all professional PA speaker bins. Up until now it's been almost impossible to buy small quantities. We sell it in 1 metre lengths by the width of the roll which is 1860mm (6').
Cat. CF-2755

$39.95



FERRITE MATERIAL & APPLICATIONS BOOK



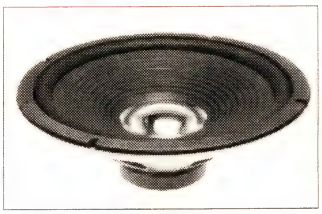
This is one subject that is very difficult to find any information on. Magnetic cores are the foundation for transformers, inductors and chokes used in so many of our electronic projects. This book is intended to be used by persons who want to (or have to) work with ferrite materials, but are not well versed in magnetics or ferrites and cannot justify outside consultation. Some of the problems addressed are:- • How to select the right type of material • How to identify an unknown material • How to measure material properties and much more. Written in 1991 by A. K. Johnson.

Softcover, ringbinder. 82 pages 212 x 132mm.

Cat. BC-1125 **$18.95**

10" WOOFER SENSATION

This is a quality woofer with foam roll surround, silver dust cover and grey ribbed cardboard cone. Listed below are all the specifications we have available.



Impedance	8Ω
Power Handling	60 watts
Resonant Freq. (approx)	38Hz
Frequency Response	38 - 3kHz
Suitable Enclosure	25L or more - sealed

Cat. CW-2117

NEW FOR '93

ONLY $20 ea

UPGRADE YOUR MIDRANGE

Quality white cone. See catalogue. Power handling 80W RMS system. Frequency response 350 - 5.5kHz.
Cat. CM-2080

NORMALLY $28.50

MAY $20 SAVE $8.50

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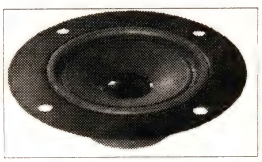
CONE TWEETER

The new cone tweeter has a black cone with plastic dust cover. It is designed to be mounted from the front of the cabinet. Ideal replacement tweeter, or for general use.



Impedance	8Ω
Power Handling	75 watts system power
Frequency Range	3000 - 16kHz
SPL	91.5dB - 2dB/W

Cat. CT-2002

NEW FOR '93

$7.95

WHAT A FLOP!

'LIFE-GUARD' PETROL VAPOUR DETECTORS

Model UA-2A This unit consists of cold sensor detector (which is situated in the bilge) wiring loom and control unit/alarm. It has an on-off test switch alarm buzzer and light. Both light and buzzer go off when fume concentration is still well below (20%) explosive level. The unit also includes a testing gas spray pack.

Cat. LA-5270 **WAS SELLING FOR $39.95 NOW $15**

Model GVM-50 This unit is permanently wired into your boat and does not contain a test switch. Its operation is automatic. It consists of an attractive circular transducer, cold sensor and testing gas.

Exclusive Cold Sensor Features

- Detects gas instantly (no warm up)
- Does not burn vapour for detection (intrinsically safe)
- Detects gas above the upper explosive limit as well
- Longest sensor life of popular type
- Unaffected by salt water and high humidity
- Can detect rapid build-up as well
- Detects high bilge water
- Endorsed by prestigious Swedish Metals Institute
- Normally closed alarm will sound if wiring broken (fail safe)

Cat. LA-5272

WAS SELLING FOR $24.95 NOW $10

BUY 10 - LESS 10%

RT MONOLYTHIC CAPACITOR MADNESS

NEW FOR '93

We've made a scoop purchase of 0.1µF 50V RT Monolythic capacitors. They are made by Centralab, which is a North American Philips company. Normal style 0.1µF monos cost 25¢ each or $16.50 pkt 100.
Cat. RC-5497

SAVE A FORTUNE WITH THESE ONLY $5 per pkt of 100

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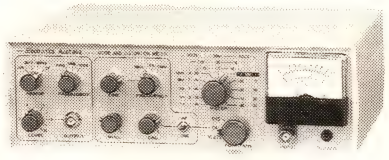
JAYCAR ELECTRONICS

KITS KITS KITS KITS KITS KITS

NEW NEW NEW NEW NEW
LOW COST NOISE AND DISTORTION METER

Ref: EA May, June 1993

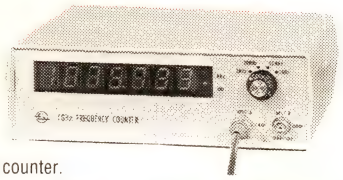
If you design, service or experiment with audio equipment, this new instrument will be an excellent addition in your range of test gear. It can measure distortion levels down to less than 0.01% at spot frequencies of 100Hz, 1kHz and 10kHz, as well as providing a built-in low distortion oscillator and AC millivoltmeter. This project is essential if you wish to assess audio equipment accurately and is quite straight forward to construct. Commercial units sell for over $600. The Jaycar kit is supplied with MKT capacitors and 1% metal film resistors, PCB's, instrument case and anodised gold front panel label to give this project a truly unique finish.



Cat. KA-1751 **$139.50**

LOW COST 1GHz FREQUENCY COUNTER KIT

Ref: EA 4/93



This new design by EA is based around their 50MHz version, published in Feb 1993, but offers 7 digits of resolution, and operation up to 1GHz. Without doubt, this is definately the cheapest way to get into a 1GHz counter.

The Jaycar kit is supplied complete with instrument case, professionally punched and screened front and rear panels; mains transformer; PCB and all specified components. Only the Jaycar kit is supplied with 1% metal film resistors and MKT caps throughout plus a clear red perspex lens for a more professional appearance.

Cat. KA-1750 **$149.50**

Audio Power Meter Kit

Ref: Silicon Chip April 1993

This project from Silicon Chip is a breath of fresh air amongst the flood of novelty 'VU meter' type LED display kits. With the wide dynamic range offered by todays CD's it's all too easy to over-drive your speakers without being aware of it! By using this low-cost circuit you can now monitor power levels from 200mW up to 100W RMS using a LED bargraph display. The Jaycar kit is supplied with PCB, components and mounting hardware. No box supplied as most constructors will probably choose to incorporate into existing equipment. Requires 12V AC. Power supply Cat. MP-3020 $16.95.

Cat. KC-5131 **$24.95**

VIDEO SWITCHER

Ref: Silicon Chip June 1992

Do you have two or three VCR's and need to watch and dub tapes between them, or need to copy old Beta tapes to VHS, or from your camcorder to your VCR?

The kit includes box, front and back Scotchcal labels, video modulator and all specified components. Options are 12V AC 500mA plugpack.

Cat. KC-5116 **$129.95**

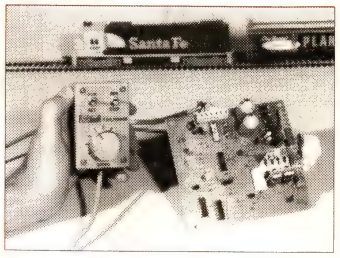
PLAYMASTER "PRO SERIES ONE" POWER AMP KIT

The last Batch! Hitachi have discontinued the MOSFETs, so that spells the end of this great amplifier. We've made one final batch, and that's all folks. See 1992 catalogue for full specs.

Cat. KA-1725 **$599**

TRAIN CONTROLLER AND REMOTE CONTROL KIT SPECIAL

See catalogue for full details:
Train Controller Cat. KC-5028 $89.00
Remote Control Cat. KC-5029 $149.95
$238.95 TOTAL

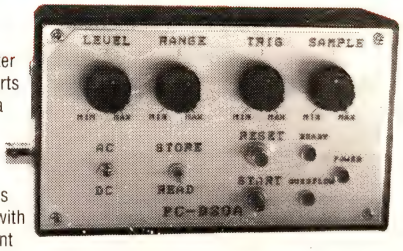


BUY BOTH TOGETHER THIS MONTH AND SAVE $29 ONLY $209.95

DIGITAL STORAGE OSCILLOSCOPE ADAPTOR FOR PC's

Ref: Electronics Australia February 1993

This easy to build unit connects to the printer port of your IBM compatible PC, and converts it into a digital sampling oscilloscope with a bandwidth of over 60kHz. You can permanently load and save waveforms to disk - zoom in on any part of the waveform, and superimpose two waveforms for comparison. The Jaycar kit is supplied with all specified components, PCB, box and front panel label. RS-232 cable not supplied.



Cat. KA-1748 **$85**

40 WATT 12 - 240V INVERTER

Ref: Silicon Chip February 1992

Cat. KC-5108 **$99**

Jaycar ELECTRONICS

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FAX (02) 743 2066

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PENRITH	199 High St (047) 21 8337 Mon-Fri 9-5.30 Thurs 8.30 - Sat 9-4pm Sun 10-4pm
RHODES	6 Leeds St (02) 743 5222 Mon-Fri 9 - 5.30

REMOTE CONTROL

BY BOB YOUNG

Unmanned aircraft – the ultimate in remote control

During the 1991 Gulf War, the usefulness of unmanned aircraft passed almost unnoticed. What did not pass unnoticed was the suffering of the pilots captured after being shot down over Iraq. However, if unmanned aircraft were used to their full capability, there would be very little risk of pilot casualties.

In the Vietnam War, America lost more than 2500 manned aircraft and about 5000 of her airmen were killed. Nearly 90% of all US servicemen taken prisoner were pilots and crewmen.

Interestingly enough, the Vietnam War saw the birth of a successful remotely piloted vehicle (RPV) in the form of the Ryan 147 series. This jet RPV is now out of production but lives on in the form of the Chinese CHANG HONG 1, a reverse engineered AQM-34N which was shot down over China around 1970. It was unofficially reported that up to 20 MIG fighters made between 30 to 50 passes at this little drone before they shot it down.

The story is always the same in regard to the survivability of these tough little aircraft. They are very hard to shoot down. Consider the following quotes:

(1). "This...target was... flown against the concentrated gunfire of the (British) Home Fleet during an exercise in the Mediterranean. For two hours, every gun in the fleet tried in vain to destroy this lone, slow and fragile target, but it was recovered safely".

(2). "Thousands of rounds of radar-directed fire from a sophisticated air defence gun, as well as hundreds of rounds of fifty calibre, were expended on an unmanned vehicle flying well within range. The unmanned vehicle flew on without a scratch".

There is little room for doubt about the survivability of RPVs but the truly noteworthy feature of these quotes is that they were issued at an interval of 47 years.

The first quote, which comes from Richard A. Botzum's "30 Years of Target Drone Aircraft", was discussing a flight made by a Fairy Queen biplane in 1933. The second was quoted during a US Government hearing in 1980.

The Vietnam experience

If more proof is needed of the survivability of UMAs (unmanned aircraft), then consider the following statistics. In the same war that saw 5000 US airmen killed in the skies over Vietnam, drones flew a total of 3435 operational sorties in the years between 1964 and 1975. Of these, the recovery rate in the early days, was approximately 84%. In the latter years, as more sophisticated models were introduced, the recovery rate climbed to well over 90%.

After Vietnam, the proponents of UMAs were confident that RPVs had proved their case and were set to become a major new "force multiplier" in military thinking. Instead, the expected upturn in fortunes failed to materialise and five years after Vietnam, the USA did not have one single operational RPV in its inventory.

It was left to Israel to prove the point on the value of RPVs and to take the case to its logical conclusion. Israel first recognised the value of RPVs during the Yom Kippur war of 1973, when it was able to reduce its manned aircraft losses by using inexpensive Chukar decoys to deceive and saturate Egyptian SAM batteries along the Suez Canal.

Shortly after that war, the Israeli government charged the IAI and Tadiran companies with developing small, versatile, low-signature RPVs, able to send back real-time intelligence via a direct video link, and capable of being operated in the field by ordinary soldiers after only 3-6 months training.

The Scout and Mastiff mini-RPVs came into their own in June 1982 when Israel launched it's "Peace for Galilee" offensive against Syrian forces in Lebanon.

Some of the drones, equipped with radar reflectors to simulate full size aircraft, acted as decoys to draw the fire of Syrian gun and missile batteries in the Beka Valley. Whilst this deception was in progress, other RPVs carrying explosive charges remained undetected by Syrian radars, enabling them to home in on the radars' emissions and destroy them on impact.

The air defence batteries, thus blinded were totally vulnerable to at-

tack by manned strike aircraft, which wiped them out completely. In this object lesson in the combined use of manned and unmanned aircraft, not one single Israeli pilot was lost and Syria quickly paid Israel the compliment of acquiring Russian drone systems for its own forces.

How it all began

How did all of this automated mayhem begin? Interestingly enough, as with most things electrical, with none other than Nikola Tesla. He had begun active work on building remotely controlled devices in 1893, although the concept had occurred to him earlier. During the next two or three years, he had built several mechanisms that could be actuated from a distance and showed them to laboratory visitors, but the destruction of his laboratory by fire interrupted these activities.

The following quotes are from the book, "Tesla, Man Out Of Time" by Margaret Cheney: "In 1896 he wrote `... I designed a complete machine capable of a multitude of operations, but the consummation of my labours was delayed until 1897... When first shown in the beginning of 1898, it created a sensation such as no other invention of mine has ever produced.'"

"His basic patent was obtained in November, only after the examiner in chief had come to New York and witnessed the performance of his vessel, for he claimed it was unbelievable."

"These first robots, he wrote in 1919, he had originally considered crude steps in the evolution of the art of Teleautomatics. As he had conceived it: `The next logical improvement was its application to automatic mechanisms beyond the limit of vision and at a great distance from the centre of control, and I have ever since advocated their employment as instruments of warfare in preference to guns... In an imperfect manner it is practicable, with the existing wireless plants, to launch an aeroplane, have it follow a certain approximate course, and perform some operati at a distance of many hundreds miles'".

"The famous woman pilot Hanna Riech then undertook to fly the monster and identified the problem as a Gyro toppling under launch "G" forces. The rest is history."

The above passages refer to Tesl radio controlled boat and submari models which were demonstrat publicly in the late 1890s. They fe tured two separate RF channels whi were used in an AND gate configur tion. The basic patents used in the very early models played havoc wit some heavyweight inventors and th courts were kept busy for many year Marconi was affected as we will see and the computer industry was sub sequently denied patents on AND gat devices.

Tesla filed his basic radio transmis sion patents on September 2nd, 189 and they were granted as Patent Nos. 645,576 and 649,621 on March 20th, 1900. Later they would be contested in long litigation by Marconi but first Tesla would sue the Italian Government for infringement.

Marconi used Tesla's basic patent 645,576 to develop the equipment he used on December 20th, 1901 to transmit the letter "S" across the Atlantic from Cornwall to Newfoundland. H. Otis Pond was walking with Tesla that day and commented to Tesla that it looked as though Marconi had got the jump on him, to which Tesla replied: "Marconi is a good fellow, let him continue. He is using 17 of my patents".

On June 21st, 1943, the US Supreme court reversed an initial finding in Marconi's favour to rule that Tesla

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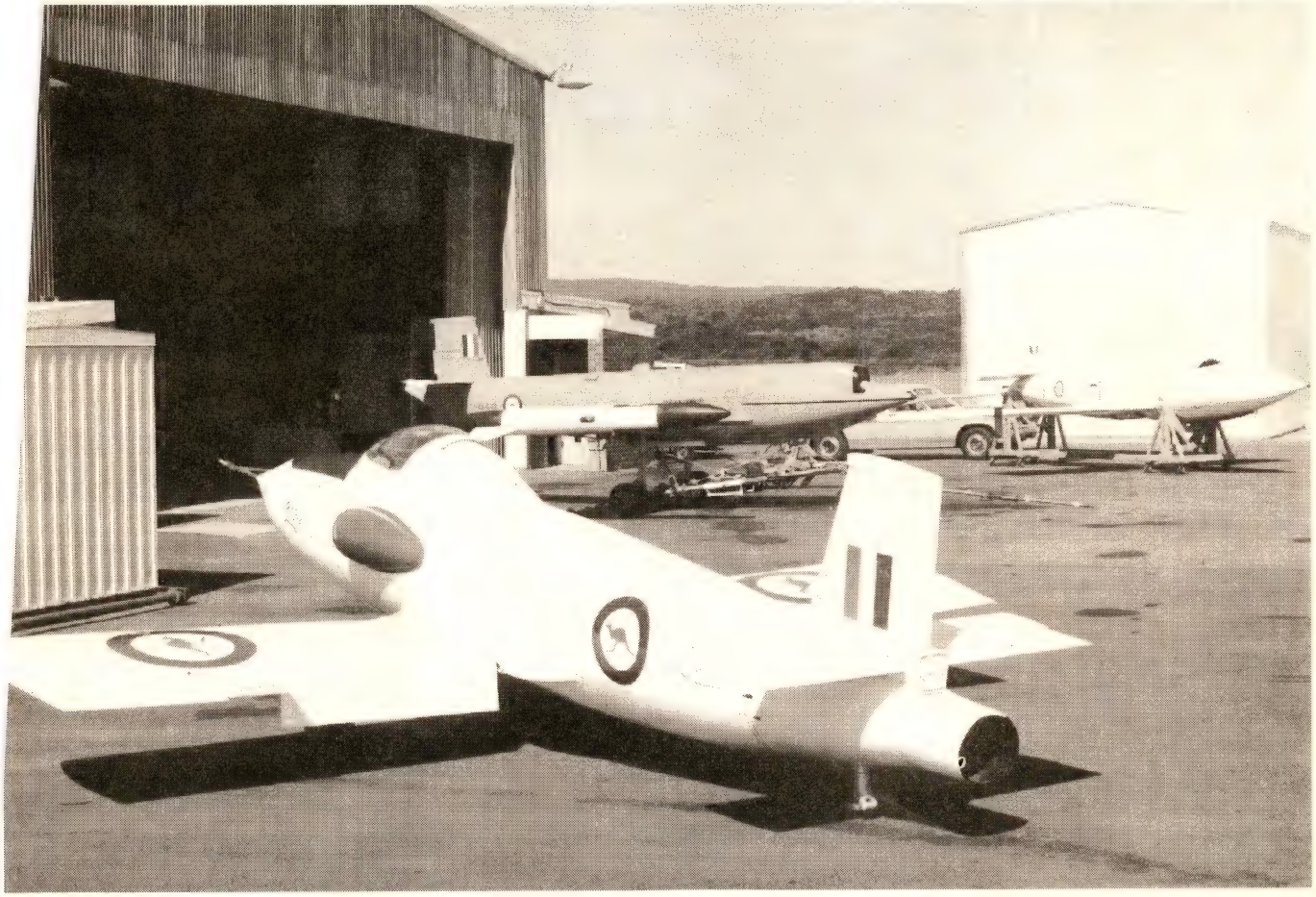


Taken in August 1977, this photograph shows three versions of Australia's very successful pilotless target aircraft, the Jindivik. In the foreground is one of only two manned versions, while in the background is the first pilotless version. The current version of the Jindivik is just in front of the hangar.

had anticipated all other contenders with his fundamental radio patents.

The next step in the development of the RPV occurred in 1913 when Lawrence Sperry first tested his gyro stabiliser – the world's first automatic pilot – in a Curtiss biplane. A mere four years later, an improved version became the heart of Sperry's "aerial torpedo", which made several successful flights for the US Navy from Sperry's Long Island airfield.

British experiments

In 1917, the British War Office, concerned with the heavy losses of British aircraft to the "Fokker scourge" across the Channel and the effects of the Zeppelin bombing raids over England, looked into the possibility of developing pilotless, remotely controlled aircraft for interception and ground attack missions. A young Army officer, Second Lieutenant A. M. Low, was placed in charged of the newly-formed RFC Experimental Works and given the task of applying his expertise in radio technology to the problem. Under the cover name of AT (Aerial Targets), a series of small aircraft, some designed by such pioneers as H. P. Folland and Thomas Sopwith, were produced for trials.

During Low's first public demonstration at Upavon in March 1917, the AT misbehaved so badly as to provoke Major Gordon Bell, one of the War Office observers, into the now classic remark that he "could throw my bloody umbrella farther than that". Subsequent efforts were scarcely more successful and thus no ATs became operational.

The main problems lay in the launch techniques and aircraft stability and in fairness to Low it must be pointed out that when the launch was successful, the radio techniques he developed could exercise long range control from a "mother" aircraft.

The Nazis had exactly the same problem with the V1 (Doodle-Bug) in WWII and after many failures of the unmanned version, a manned version was built. This fix was to no avail and there followed several fatalities. The famous woman pilot Hanna Riech then undertook to fly the monster and identified the problem as a Gyro toppling under launch "G" forces. The rest is history.

The concept of manned prototypes of the earlier UMAs was quite common and there was even an early manned version of Australia's very successful UMA, the Jindivik. These days, obsolete manned fighter aircraft are routinely converted to drones at the end of their safe service life.

Next month we will continue this discussion of remotely piloted vehicles of which there are several dozen different types in service with defence forces around the world.

References.

(1). Air International, February 1992, Unmanned Aircraft directory.
(2). Jane's Battlefield Surveillance Systems 1992-93.
(3). Tesla, Man Out Of Time, by Margaret Chaney. Prentice-Hall, Inc. Englewood Cliffs, N.J. 07632 1981.

VINTAGE RADIO

By JOHN HILL

A few old receivers from the 1920s

A while back, I was fortunate enough to get onto a few old receivers from the 1920s. Actually, I tell a lie – in this instance, they came to me. All I had to do was answer my telephone.

These sets were owned by a collector who was selling up. And he is not alone in this regard; quite a number of collectors have been forced to sell up during the past 12 months or so. Many people are enduring hard times at the moment and, when finances become strained, unessentials such as hobbies are the first to go – particularly when those pay cheques stop coming in.

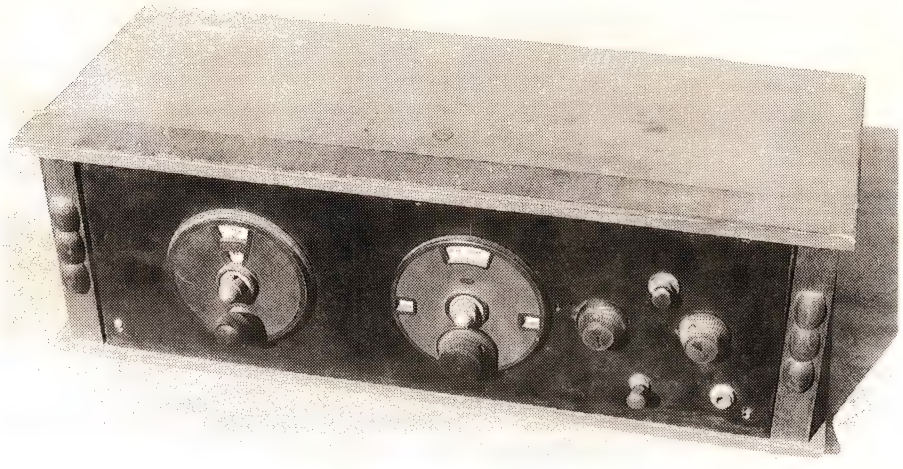
On the other hand, many such collectors have had to face the harsh reality that, due to the recession, their collections are not bringing the prices they originally paid. The true value of something is only what someone is prepared to pay for it at that particular time. If it doesn't sell, then the asking price is greater than its current worth.

The person who was offering me his radios was strictly a collector. He simply acquired old radios and stored them in outside sheds. He made no attempt to clean up any of his sets or make any effort to restore them to working order. From this description, readers can well imagine the generally neglected condition of these receivers. They were dirty, dusty and looked decidedly unloved. Add the aroma of mouse infestation and the picture is complete.

There were four radios with four horn speakers, plus three horn drivers and an upright Brown horn wit out a driver. Also included was i incomplete 1929 Airzone portable r ceiver.

Actually, the word portable shoul be used with inverted commas, b cause portables from the 1920s er were fairly hefty items. Adding a ca rying handle doesn't necessarily mak something portable!

The other receivers consisted of tw 3-valve regenerative types (detecto plus two audio); a 4-valve regenerative type with a neutralized radio frequency stage and two tuning dials; and a 5-valve TRF with two neutralized stages of RF amplification and single knob tuning. All were battery operated and used either 4V or 6V triode valves.



This is the home-made 3-valve TRF receiver. Its cabinet has been built from roughly dressed poor quality timber not unlike that used in packing cases.

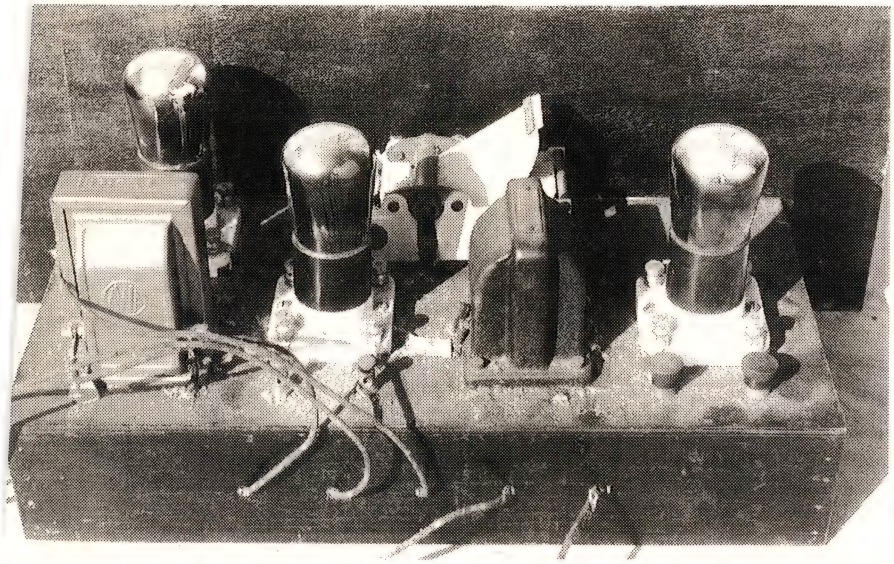
Dealer prices

If these receivers were to be found in an antique shop, one would have to spend a couple of thousand dollars or so to purchase them, regardless of their mediocre condition.

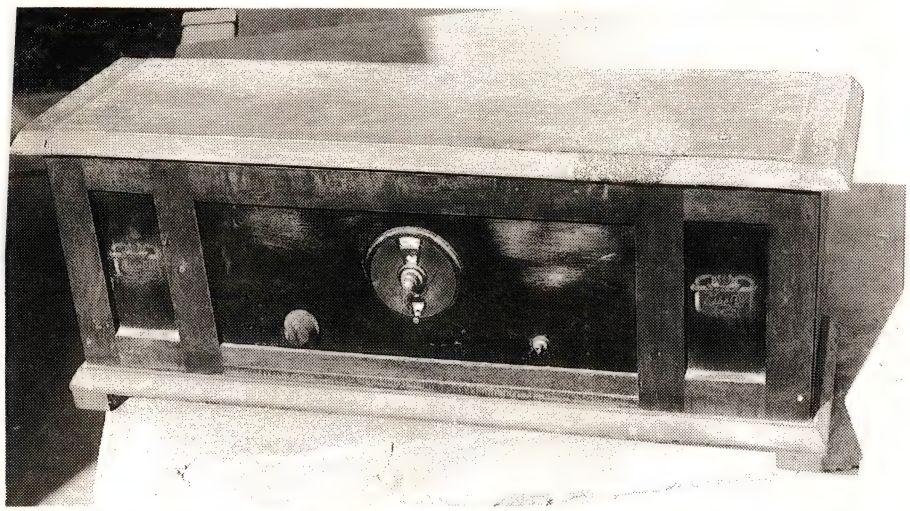
Personally, I believe that the prices dealers place on old radio receivers far exceed their worth and that their true value is generally about one third the asking price. I don't pay dealers' prices for my radios unless it is for something really exceptional.

Accordingly, I offered $600 for this collection of dusty relics and my bid was accepted. $600 was either the best or only bid that had been offered. I believed it was a fair price considering nothing was clean, tidy, or in working order. Most of what was on offer needed the full restoration treatment before any of it could be considered valuable.

Returning for a moment to antique dealers' prices, I find it incredible that when I sell a fully restored radio I cannot obtain what a dealer asks for



ack view of the home-made 3-valve chassis. There are plenty of problems here, ncluding three useless valves, two open circuit audio transformers & a broken lial, to name just a few.



This 3-valve receiver was built by "Golden City Radio" of Ballarat, Victoria. It is very long for a 3-valve set & has battery storage space at both ends of the cabinet.

a similar set in unrestored condition. In many cases, the dealer's set doesn't even work. Either I'm too cheap or antique dealers are too dear. I think the latter is more likely correct!

However, in all fairness, one must take into account the time and travel costs involved in going to auctions, garage sales, or whatever. This must be added to the price of any collectable item and the rarer the item, the more time it takes to find. If you are not prepared to do this, then the antique dealer will do it for you – for a price; his price!

Only a few days ago, I had an antique dealer complain to me that I hadn't bought a radio from him for at least a year. My reply was "when you have something I really want and it is realistically priced, then I will buy it!" Because I am interested in old radios he expects me to buy every receiver he has in stock.

This same dealer had on display a mid-1950s 4-valve Radiola with a cracked plastic cabinet, odd control knobs and a price tag of $89.00. This example should convey the message I am trying to get across about dealers' prices being too high.

Now then, let's get back to those old receivers.

Really, there is only one good one among them and that is the 5-valve TRF set. Like so many early radios, it has no maker's name but it must have been better than average in its day because it is fitted with single knob tuning. Most 5-valve TRFs from that era have three vernier dials driving three individual tuning capacitors.

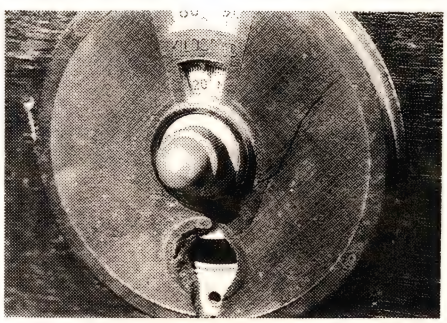
Like many TRF receivers, it is a straight set with no regeneration. Regeneration can shift the tuning of the detector circuit and is undesirable with a ganged tuning capacitor unless one section can be trimmed from the control panel.

Of the other sets, one of the 3-valvers is a home-made affair with two dials on the front control panel. Only one is used for tuning; the other is used as a vernier for the reaction control.

This little home-built set is unique in a rough sort of way, for its cabinet has been fashioned from the proverbial packing case. Although my first impression was "yuk!", I have since developed a liking for this scruffy little packing case special. It truly represents the typical home-built receiver of the 1920s, whereby the overall expense of the outfit was kept to an absolute minimum. Its only aesthetic feature is three little wooden bobbles attached to each side of the front control panel.

The other 3-valver is a large commercially made receiver built by "Golden City Radio" of Ballarat, Victoria. As with most 3-valve sets from the 1920s, it is about as basic as a regenerative detector receiver can be. These radios were produced in quantity for the budget end of the market. Three valves gave sufficient power for reasonable loudspeaker operation on local stations.

Unfortunately the dial on the front control panel had been smashed. As luck would have it however, I have an



The "Golden City Radio" receiver has a smashed dial – just one of the many problems in this particular set. Fortunately, a spare dial is available but general restoration work on old receivers is difficult due to lack of spares.

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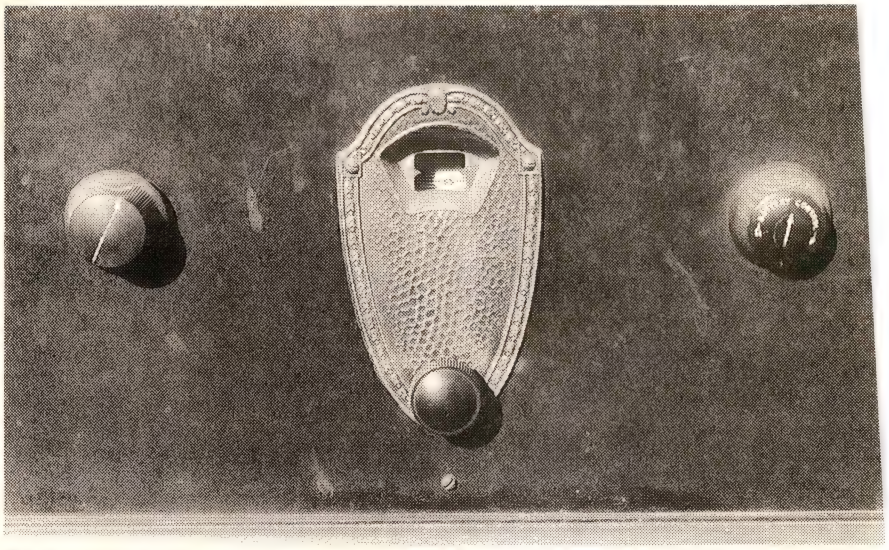

This rather uninspiring control panel belongs to the 5-valve TRF receiver. The controls are, from the left: volume, tuning & filament rheostat. The latter contro also serves as an on/off switch.

These four horn speakers came with the old receivers. A lot of work is required to restore them to working condition.

identical unit that can be used as a replacement when I finally get around to restoring the set.

Another problem with this particular receiver is with the top of the cabinet lid, for it has been subjected to a massive paint spill. There is a scab-like blob of lacquer on the lid which will take quite a bit of work to remove without damage.

Finally, there's the 4-valve TRF set with the single RF stage. While this unit appears to be commercially made, once again there is no brand name. Some of those manufacturers of old were not very proud of their products. It is a poor state of affairs when they were too ashamed of what they made to put their name on it.

Or was it was a way around paying royalties or taxes or something? Or maybe the sets sold so fast that no-one had time to fit a badge or nameplate!

This little 4-valver is a fairly compact outfit and its cabinet has double doors underneath the receiver to house the batteries. Receivers with self-contained batteries were a good deal tidier than those without. Batteries strewn all over the floor, together with their connecting wires, must have been a great annoyance during the early days of radio. Mains-operated sets must have been a great relief after the humbug of battery power.

The 4-valve regenerative receiver was commercially made & has a stage of neutralized radio frequency amplification. Note the battery storage space at the bottom of the cabinet.

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All the horn speakers were fairly sad looking, especially an Amplion 'Senior Dragon". This particular horn speaker has an oak flare and, like most timber flares, has not survived its near 70 years very well. It has several splits and chips and the rubber parts have also gone out of shape, a common problem with old Amplions.

Another unit is a Claritone, a horn speaker that has quite a large flare. Once again, it is only in fair condition and is rusting due to peeling nickel work.

The big Brown horn is quite a stylish shape and should restore fairly well, although it will require a full repaint job. Do anyone know where I might get onto some "Brown" transfers?

Every one of the horn speakers requires the full restoration treatment and that includes a rewind of the driver coil in some instances. However, it was not a bad collection of junk for the price, even though very little of it is in good condition and there is a lot of work to be done.

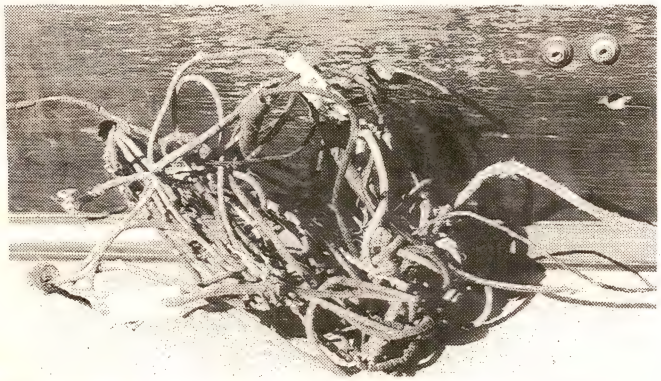
Valve checks

This is a project for the future. So far, I have done nothing other than check the valves – and that was a somewhat disheartening experience.

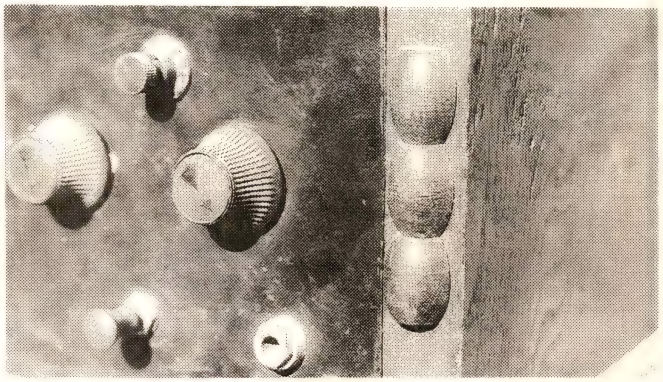
Out of 19 valves (including the Airzone portable), there was only one good one. Some base pin resoldering may retrieve some of them, otherwise I will be scrounging around for some old 4V and 6V triodes.

But that is what vintage radio is all about – searching, scrounging, finding and restoring. There would be little satisfaction if every set was in perfect working order, although a good one now and then would be nice.

Every time I add an old 1920s radio or horn speaker to my collection, I reckon that it will be the last I will ever see. I have said that a few times now but something else always seems to come along. It just goes to show that there are still odd bits and pieces of 1920s equipment out there. It is only a matter of finding it! **SC**



This wiring mess once formed the battery leads of the 5-valve TRF receiver. A complete rewiring job should solve the problem. The two sockets are for the speaker leads.



These bobbles on the home-made 3-valve TRF receiver did little to improve its appearance & certainly did nothing to improve the set's performance.

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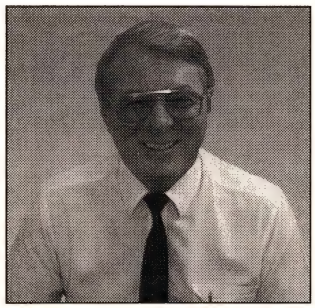

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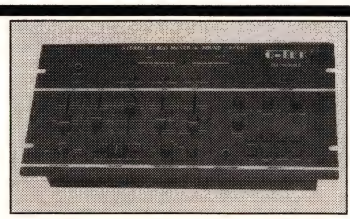

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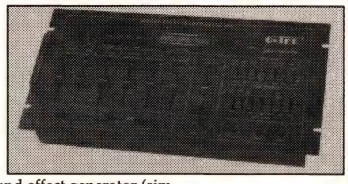

6 channels with 10 inputs. Inputs include: mic 1, mic 2, phono 1, phono 2, phono 3, line 1, line 2, line 3, line 4 and line 5. Two seven band graphic equalisers and master controls allow precise sound refinement. Features sound effect generator (simulates storm, telephone, machine gun, siren, shooting, ambulance, laser and bombing) and echo control. Twin LED VU displays for master output. A must for the serious DJ, sound technician or hi-fi buff.

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(EA Jan 92)
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(SC July-Aug '88) The Discolite flashes party lights on and off in beat with music from your amplifier.
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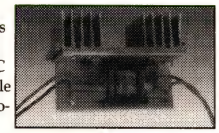
K 5805 **$159.50**

Fluorescent Light Inverter Kits

(SC Feb '91)



This kit enables you to build a high power DC inverter suitable for driving fluorescent lights from a 12V source typically a car battery. Ideal for use in camping or boating as fluorescent light offers 2 big advantages over normal incandescent lights. Namely more even 360° light spread and low current drain. Two kit versions to choose from - 16W and 20 to 40W.

K 6350 16W Version **$35.95**

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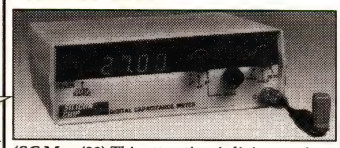

(SC May '90) This attractive 4-digit capacitance meter is designed for the workshop or laboratory. It can measure capacitance from 1pF up to 9999µF in seven ranges with an accuracy of better than ±1%. An over-range LED flashes whenever the capacitance value is too large for the range selected.

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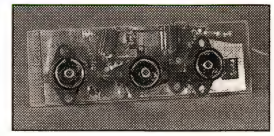

This kit enables you to transmit TV signals from the UHF output of your VCR to a second TV set in the house. The kit is complete with box and has a range of about 20 metres. Requires 12 Volts DC. (pictured without case-included).

K 5860 Normally $74.95

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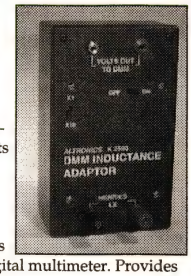

(EA Dec '92)
Measuring the inductance of wire-wound components has not been easy until now, but here's a handy adaptor unit. Simply plugs plugs into a standard digital multimeter. Provides two direct-reading measurement ranges.

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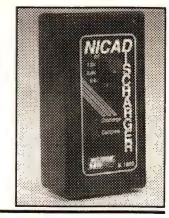


(SC July '92)
Designed to rid your nicad batteries of the memory effect and regain full recharge potential. It discharges your nicads correctly to enable a full recharge. Suits most battery packs. Great for mobile phones, battery drills, toys etc.

K 1640 **$24.95**

Rejuvenate Those Old Ni-Cad Batteries to Their Full Potential!

The Powerhouse 1200W Inverter Kit

(EA Feb '92)

This Power Inverter will provide all your power requirements from a heavy duty 12 or 24V battery. Using the latest Mosfet output stage and toroidal transformer this inverter is both efficient and will deliver high surge currents. The Powerhouse has been designed not only for rugged bullet proof operation but for ease of construction, two PCB's hold all circuitry with one inter-connecting cable. This kit comes to you in a fully drilled, pre punched chassis complete with silk screened front panel. Assembly of the kit is simplified as the majority of components mount on a single PCB. Thus virtually eliminating all external terminations. Suitable for use in camping, boating, fishing, mining, farming, remote settlements etc.

Includes Heavy Duty Battery Leads!

K 6790 Kit Version Normally $799.00, **This Month Only $749.00**
K 6792 Fully Built & Tested 12V Input
K 6793 Fully Built & Tested 24V Input **$999.00**

ALTRONIC COMPONENTS

PHONE ORDER - FREECALL 008 999 007

) Cleaner

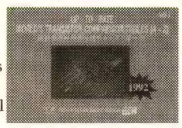
re clearing ur CD ners. These ers use the ct motion for oving small ace scratches general dirt grime.

20 NORMALLY $17.95

s Month Only **$7.95**

Save Over 50%

p-to-Date Worlds ansistor, Diodes, hyristor IC's omparison Table ooks



ese extremely mpact books gives rief description, ecifications as well equivalents for ansistors, diodes, thyristors and IC's. xcellent reference books for professionals d hobbyists alike. Each contains hundreds f pages with thousands of components.

1270 ransistors, Diodes, Thyristors & IC's **$19.95**

1275 A - Z Transistors **$18.95**

1280 O - µ Transistors **$18.95**

Ideal Reference Books for the Hobbyist & Professional Buy All 3 for $49.95 & SAVE!

13.8V 1A UPS

Designed for critical applications where it is important that products remain operational during mains failure, this UPS (Uninterruptible Power Supply) will supply 12V at 1.2 Amps via its internal inbuilt sealed lead acid battery even when the mains has failed. Ideal for use with alarm systems etc.

M 9090 **$69.95**

Mini Strobe Signal Lamps

New weatherproof design ideally suited to outdoor applications. Blue lens. 1 watt output. Uses Xenon tube for high energy flash. Flash rate approx 75 per minute. 12V DC 150mA. Dimensions: 70Ø x 53h mm.

S 5445 **$19.50**

Fully Weatherproof

Passive Infra-Red Movement Detector

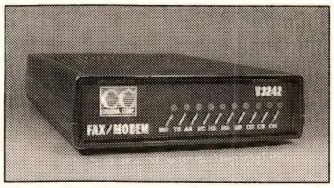
Incorporates Pulse Count Triggering
Using the latest technology this compact Passive Infra Red Detector (P.I.R.) features Pulse Count Triggering which virtually eliminates false alarms.

S 5302 Normally $62.50,

This month Only $49.00

Super Small! Suits S 5485 Panel Opposite

CC V3242 Fax/Modem



The Comma 3242 is an integrated, high performance modem that supports all popular CCITT and Bell modem standards, including the newest standard, CCITT recommendation V32bis for dial up communications at 14.4K bit/s and all CCITT standards for full FAX operation. The modem can operate full-duplex and half-duplex in synchronous and asynchronous data format at 9600, 7200, 4800 and 2400, 1200 and 300 bit/s.

Send faxes from home. The Comma Fax/Modem operates like a fully featured fax machine. Your faxes can now be sent directly from your PC without having to print them first.You can view incoming faxes on-screen or print them using a standard dot matrix printer. Only print the faxes you want to keep - just think of the savings on expensive fax paper.

Time Saving. The Comma Fax/Modem will also receive faxes in the background while you continue to work. When faxing out, the Fax/Modem will redial an engaged number so you can be sure your faxes are sent. The software also automatically keeps a complete log of both incoming and outgoing faxes. Also supported are cover pages, broadcast faxes, and scheduling. The software keeps a database type register of regularly used fax numbers for easy retrieval.

It's a modem as well. The Comma Fax/Modem is a fully AT command compatible modem. Features include V22/V22bis standards (V21/23 is an option) both 1200 and 2400 baud rates are supported as well as auto answer, dialling and disconnect. You will find it compatible with all popular communication software.

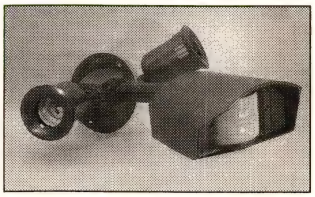
Free Software. With each modem you will receive the QL2 Fax/modem software featuring both pull-down and mouse support.

Turn Your PC or Mac into a Fax with This state-of-the-Art Fax/Modem!

D 1595 **$699.00**

New From ALTRONICS

Passive Infra-Red Lite Aide Floodlight Control

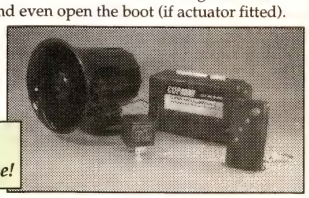


How often have you thought there could be a prowler outside your door? Install a Lite Aide and (once armed) any "guest" will be floodlit when detected by this highly sensitive Infra-Red Detector. The Light Aide detects a moving person or vehicle by comparing the background temperature with a rapid change of temperature across the detection beams. So when Lite Aide detects movement across the coverage area, it will turn on the floodlight(s) for 10 seconds to 15 minutes as pre-adjusted.

S 5350 Was $49.95, Now Only **$39.95**

Cheap Security!

High-Tech Remote Car Alarm



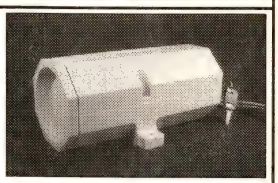
This amazing model features just about everything you could imagine! Multi-function keyring remote control will arm and disarm alarm (and activate central locking if fitted), chirp the horn, turn on the car headlights, panic and even open the boot (if actuator fitted). One remote can control two alarms (in two cars). Other features include starter inhibit, valet mode, central locking interface, flashes car indicators when tripped, auto reset, user programmable options plus much more.

S 5230 Normally $249.00

This Month Only $199.00

$50 Off Amazing Value!

Satellite Siren

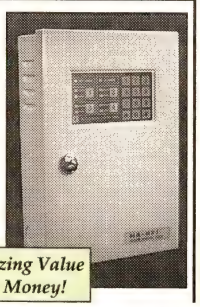


Connects easily into most car or house alarm systems. This self contained compact unit delivers a massive 120dB of deafening sound pressure once activated. It connects simply via 3 wires to any alarm system (car or house) that has an output that is normally negative (or low). When the alarm system is activated and the output goes positive (or high) the siren will sound. The siren will also operate if the wires to it are cut. Hence it adds extra security to your system if someone tampers with it to disable it. Simply armed and disarmed via inbuilt key switch.

S 5235 Normally $69.95

This Month Only $59.95

4 Sector Alarm Control Panel



For Commercial and Residential Premises. 4 independent sections accept N.O. and N.C. sensors. Any sector can be individually isolated, (e.g. when at home you may want to turn on perimeter sensors, allowing movement inside). User selectable 4 digit pin number allows you to arm and dis-arm the alarm via digital keypad. Sector 1 - 24 hour (Panic and Tamper), Sector 2 - Instant, Sector 3 - Hand-over Feature, Sector 4 - Delayed. Features dual intelligent siren drivers (i.e. if one speaker wire is cut the other will sound). Constructed in sturdy steel case. Requires 1.2Ah gell cell for battery back-up (S 5065), 16V AC plug pack (M 9025) and 8 ohm horn speakers (C 2015).

S 5485 Normally $249.00, **This Month Only $199.00**

Amazing Value for Money!

Anti-Static Wrist Strap

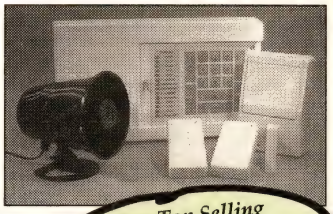
Velcro adjustable wrist strap allows full freedom of movement while protecting components from static damage. Fantastic for assembly, service work and enthusiasts alike!

T 4001 **$14.50**

New From ALTRONICS

UHF Microprocessor Controlled Wireless Security System

Why Pay A Commercial Security Firm A Fortune To Wire Your House or Office. This Fantastic System Installs In An Hour or Two And Uses No Wires



Our Top Selling Security System Through 1992

Apart from the flawless operation of the system one of the great features is its application with rented or leased premises - let's face it, money spent on installing a wired system in your home or office, factory, etc is irrevocably lost when you move on. With this system you simply take it with you. Ultra high-tech and push button operation makes this unit a breeze to install and operate. Features 6 sectors plus 2 x 24 hour fire and tamper circuits. The **S 5240** system includes the main controller, 1 passive infra red movement detector, 1 window or door reed switch, wired siren, power supply back-up rechargeable battery, and a special personal remote control. All sensors are radio transmitters which means no wiring is necessary (except for the plug pack and siren). The whole system is coded so it can not be interfered with and can be changed any time by the owner, Each individual sensor can be easily set to operate any sector. The main controller utilises the latest EEPROM technology which means things like selecting user on/off codes, isolating sectors etc. are a breeze. Includes a myriad of other amazing features, too many to mention.

Complete system includes:
1 x Control Panel 1 x Passive Infra Red Detector-Transmitter 1 x Door-Window reed Switch-Transmitter 1 x Hand Held remote Control-Transmitter 1 x Horn Speaker - 10 watt-wired 1 x 240V AC adaptor 1 x 1.2Ah Back-up Battery 1 x Set of batteries for all transmitters

Extra Sensors etc. Available Separately

S 5240 Complete System Price Only $679.00

This Month Only $599.00

ALTRONICS 1993 RETAIL CATALOGUE If you haven't received yours call us on 008 999 007 for your free copy!

ALTRONIC COMPONENTS

PHONE ORDER - FREECALL 008 999 007

ALTRONIC COMPONENTS

Aviation Headset

1000's Sold Across Australia - Includes 2 Year Warranty!

C 9073 Pictured

It was not to long ago when spending $450.00 on an Aviation Headset was not uncommon. Altronics changed all that when we released our C 9070 Aviation Headset for under $189.00. Now with the edition of the flexible boom unit and helicopter version (fitted with a Nato plug) our headsets have gone from strength to strength. Add to this enhanced microphone, improved lead shielding and headband comfort these headsets must be the best value for money in Australia!

C 9070 Standard Model **$189.00**

C 9073 New Flexible Boom Model **$225.00**

C 9072 New Helicopter Model **$249.00**

Aviation Push-to-Talk Switches

Includes quality velcro strap and simple push-button operation.

C 9090 $29.95

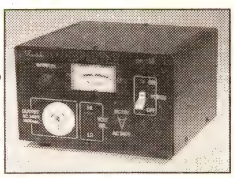
Micron Sure Shot Desoldering Tool

Exclusive to Altronics in Australia. This stand alone, fully self-contained desoldering tool makes it a breeze to remove components from any PCB. Even double sided, through hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out. **Features:** • Totally self contained • Light and compact • Anti static tip • Easy to use • Simple to clean and maintain • Variable tip temperature. The ***Sure Shot*** generates a high speed vacuum every time the trigger is squeezed. This vacuum causes the molten solder to flow into the collection reservoir contained within the unit. Here the molten solder solidifies into small particles. With its inbuilt variable temperature control the ***Sure Shot*** is ideal for single sided, double sided and through hole plated P.C.B.'s. With just a couple of squeezes of the trigger all holes are left solder-free for easy removal of the component.

T 1270 $349.00

The Micron Sure-Shot Hand Held Desoldering Gun de-solders 30 plus joints a minute and is around half the cost of the competition

300 Watt Inverter



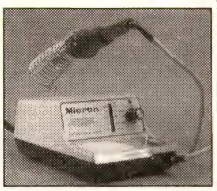
This nifty inverter converts 12 Volts DC to 240 Volts AC. Includes an on/off switch and a light & heavy load switch with metered output. Works well with most electrical equipment.

M 8120 NORMALLY $249.00

This Month Only $199.00

Fantastic for Camping, Farmers etc. Save 20%

Micron Soldering Station



Electronic Temperature Controlled, Temperature Selectable, Soldering Station

Features variable temperature control, LED bargraph temperature readout, quality silicon lead, light weight handle sponge tray, and super heavy duty iron clad tips etc. Range of tip sizes available.

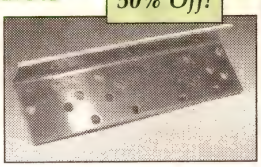
T 2440 $169.95

This Month $149

Suits Hobbyists and Professionals Alike!

High Quality TO-3 Transistor Mounting Brackets

50% Off!



We have a limited quantity of these great brackets. Made from heavy duty 3mm aluminium. Pre-drilled for four TO-3 transistors and three mounting bolts. Dimensions 152w x 42d x 23h mm approx. Fantastic for power supplies, amps etc etc. Sorry Not Available from Altronic Re-Sellers

HR0595 $6.00

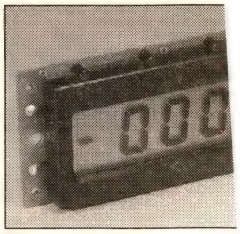
Hurry Stocks Limited!

Multi-Purpose Electrical Tester

This fantastic gadget will test a myriad of electrical and electronic components. It is simple to operate and is sure to amaze you with it's uses. Best of all, it's priced to make it a must for every technician, electrician and enthusiast. Tests continuity/resistance (100MΩ, 50MΩ and 5MΩ ranges), with buzzer and/or LED indication. Dead easy to use. Will check fuses, light bulbs, wiring, elements, speakers, diodes/LEDS, transistors, transformers and the list is endless.

Q 1250 Amazing Low Price **$17.95**

Digital Voltmeter



This well designed LCD module will take care of most of your requirements of digital voltmeter displays. Voltage range and decimal place options are easily configured by PCB links. Small, compact, reliable and comes complete with plastic surround to give a professional finish.

Specifications:

Digits: .....3.5, 13mm Height
Ranges:....200mV, 2V, 20V, 200V, 1000V DC
Input Impedance:.....10MΩ
Power Supply: .....9V DC
Over-range Indicator: .....'1'
Decimal Place: .....Variable
Accuracy:.....+/-0.5% (2 digit)

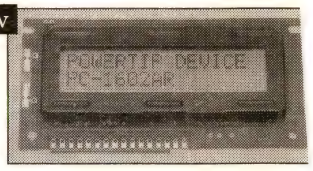
Ideal for Power Supplies Etc.

New From ALTRONIC

Q 0560 $39.95

Alphanumeric Dot Matrix LCD Module

New



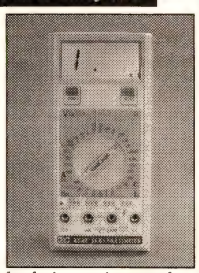
This compact LCD module has 96 inbuilt ASCII characters and 92 special letters which can be displayed on a 16 character by 2 line screen. The module will hold the current input on the display using its own built in memory, thus making it very easy to drive. Some possible applications could be within fax machines, measuring instruments, telephone applications or any other area where machine user feedback is required.

Z 7299 $35.00

This Module can be Programmed for Personalised Messages for Your Car, Alarm System etc. etc.

Digital Multimeter & LCR Meter

Includes Carry Case



This digital meter tests in addition to standard multimeter ranges, capacitance and inductance, enabling you to test a wide variety of components.

Indispensable for the design engineer, technician and enthusiast alike.

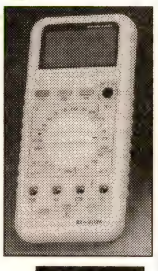
Q 1062 $149.00

Universal Multimeter Carry Case Q 1052

Excellent padded vinyl case with zipper. Suitable for all meters advertised this month.

Free With Each Multimeter Ordered this Month

24 Range Digital Multimeter



Features 1% Accuracy and Massive 20A Current Check. 3.5 digit. Ranges include AC & DC voltage, AC & DC current, resistance, diode check, transistor check etc. this meter would have to be one of the best value multimeters available today.

Q 1030 $99.00

New

Q 1040 Protective Holster to Suit **$15.95**

24 Range Digital Multimeter

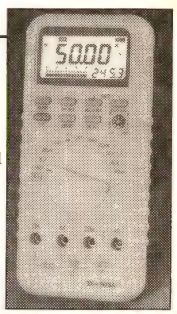
With Frequency Measurement and Capacitance Meter. Includes frequency and capacitance ranges. With the addition of a built in logic probe and screen hold button it would have to one of the most useful DMM's available today.

Q 1035 $169.00

Q 1040 Protective Holster to Suit **$15.95**

New

Auto Ranging 3.75 Digit Digital Multimeter



Triple LCD Display Includes 2 Digital & 1 Bar Graph. This incredible multimeter would have to be one of the most comprehensive on the market today. It is capable of doing all the normal voltage, current and resistance readings, as well as capacitance, frequency, minimum and maximum sampling, relating measurements, storing previous readings, limit setting, signal transistor gain checking and is full auto-ranging.

Q 1038 $199.00

New From ALTRONICS

Q 1040 Protective Holster to Suit **$15.95**

PHONE ORDER - FREECALL 008 999 007

AUSTRALIA WIDE • Jet Express • ALTRONIC COMPONENTS

otorola KSN1177A iezo Twin Tweeter

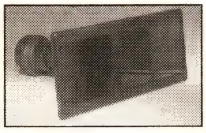
Twin e bullet ides out-ding astic perfor-nce. Rated 00 Watts.

170 **$39.95** New

Ideal Replacement Tweeter, or for That High Power Speaker Project! Piezo Design Means no Crossover is Required - Virtually Indestructible

Motorola KSN1151A/1142A

lorn part no. KSN1151A, driver part no. SN1142A. iezo Horn peaker suited o Hi Fi, PA and ound reinforce-nent. With uilt-in protec-tion.



Dimensions:.....265 x 110mm
Frequency Response: ....1.8kHz - 30kHz
SPL:.....92dB (2.83V/1m)
Rated Power Input:.....75w nom, 400w max
C 6155 **$90.00**

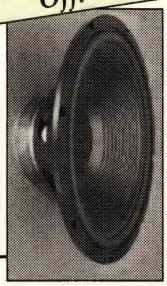
Used Extensively in Professional Live Sound Stage Systems Throughout the World

Polypropylene Speakers

Amazing 40% Off!

These fantastic speakers are ideal replacement speakers or for your own speaker design Features extended bottom-end frequency response performance and cabinet size reductions for a given level of performance. The lightweight plastic cones offer levels of performance above that of conventional cardboard cones. The cone is more rigid and does not "break-up" (flex) as much as its counterparts.

Cat No.	Size	Watts RMS	Watts Max	Was	This Month
C 3045	6.5" Midrange	30W	50W	$27.50	**$16.50**
C 3055	6.5" Woofer/Midrange	30W	50W	$29.95	**$17.95**
C 3060	8" Woofer	60W	100W	$49.95	**$29.95**
C 3065	10" Woofer	60W	100W	$69.00	**$41.40**
C 3070	12" Woofer	100W	150W	$99.00	**$59.40**
C 3075	15" Woofer	120W	200W	$129.00	**$77.40**



D25 Computer Plugs & Sockets

Save Up To 20%

Standard Solder Pins

	Was	Ea This Month	Ea 10up
P 3000 9 Pin Male	$1.50	$1.35	$1.20
P 3010 9 Pin Female	$1.50	$1.35	$1.20
P 3100 15 Pin Male	$1.75	$1.60	$1.40
P 3110 15 Pin Female	$1.75	$1.60	$1.40
P 3200 25 Pin Male	$1.95	$1.75	$1.60
P 3210 25 Pin Female	$1.95	$1.75	$1.60
P 3070 15 Pin D9 Male	$4.35	$3.95	$3.50
P 3080 15 Pin D9 Femle	$4.35	$3.95	$3.50

Back Shell Covers

	Was	Ea This Month	Ea 10up
P 3090 9 Pin	$1.95	$1.80	$1.60
P 3190 15 Pin	$2.20	$1.95	$1.80
P 3290 25 Pin	$2.50	$2.20	$2.00

Spacer Screw Packs

	Was	Ea This Month
P 3310 Pack 10 Sets	$4.95	$4.15
P 3312 Pack 100 Sets	$39.95	$34.95

Right Angle PCB Mount

	Was	Ea This Month	Ea 10up
P 3020 9 Pin Male	$2.25	$2.00	$1.80
P 3030 9 Pin Female	$2.25	$2.00	$1.80
P 3120 15 Pin Male	$2.50	$2.25	$2.00
P 3130 15 Pin Female	$2.50	$2.25	$2.00
P 3220 25 Pin Male	$2.95	$2.65	$2.40
P 3230 25 Pin Female	$2.95	$2.65	$2.40

Straight Pins PCB Mount

	Was	Ea This Month	Ea 10up
P 3040 9 Pin Male	$1.95	$1.75	$1.60
P 3050 9 Pin Female	$1.95	$1.75	$1.60
P 3140 15 Pin Male	$2.10	$1.90	$1.70
P 3150 15 Pin Female	$2.10	$1.90	$1.70
P 3240 25 Pin Male	$2.50	$2.25	$2.00
P 3250 25 Pin Female	$2.50	$2.25	$2.00

All Connectors Gold Plated. - As Supplied to Manufacturers Across Australia

Portable Gas Soldering Iron Kit

Great for working on the boat, car, farm TV antenna or anywhere in the field. One refill lasts up to 60 minutes. Uses standard cigarette lighter butane gas. **Includes:** • Hot Blower Tip • Hot Knife Tip • Polyfoam Cutter Tip • Burner Tip
Sorry - Not Available from ALTRONIC Dealers at these Prices!
T 2470 Normally $79.95
This Month Only $64.95

Famous Portasol Brand

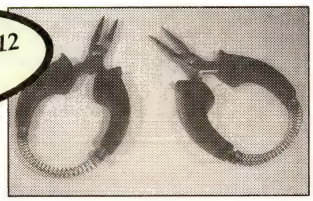
Switches

SPST chassis mount. With built in 240V AC Neon light.
S 3218 Normally $1.70
This Month Only .60¢ ea

Palm-Grip Series Hand Tools

A must for all tool boxes. Handy palm-grip size features spring return and stainless steel construction.
T 2710 Flat Nose Pliers
T 2720 Needle Nose Pliers
ALL NORMALLY $9.95 ea
This Month Only $7.95 ea

Buy Both for $12 & Save!

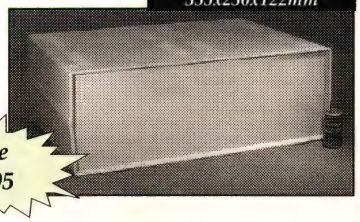


Super Large Instrument Cases

Massive 355x250x122mm

Designed to house amplifiers, inverters, power supplies micro-processor equipment etc. Built-in mounting posts for PCB's, transformers etc. Ventilated for efficient air-flow cooling. Extra tough, Super finish front and rear panels. Pictured battery for size comparison only.
H 0490 Case **$29.95**

Were $39.95



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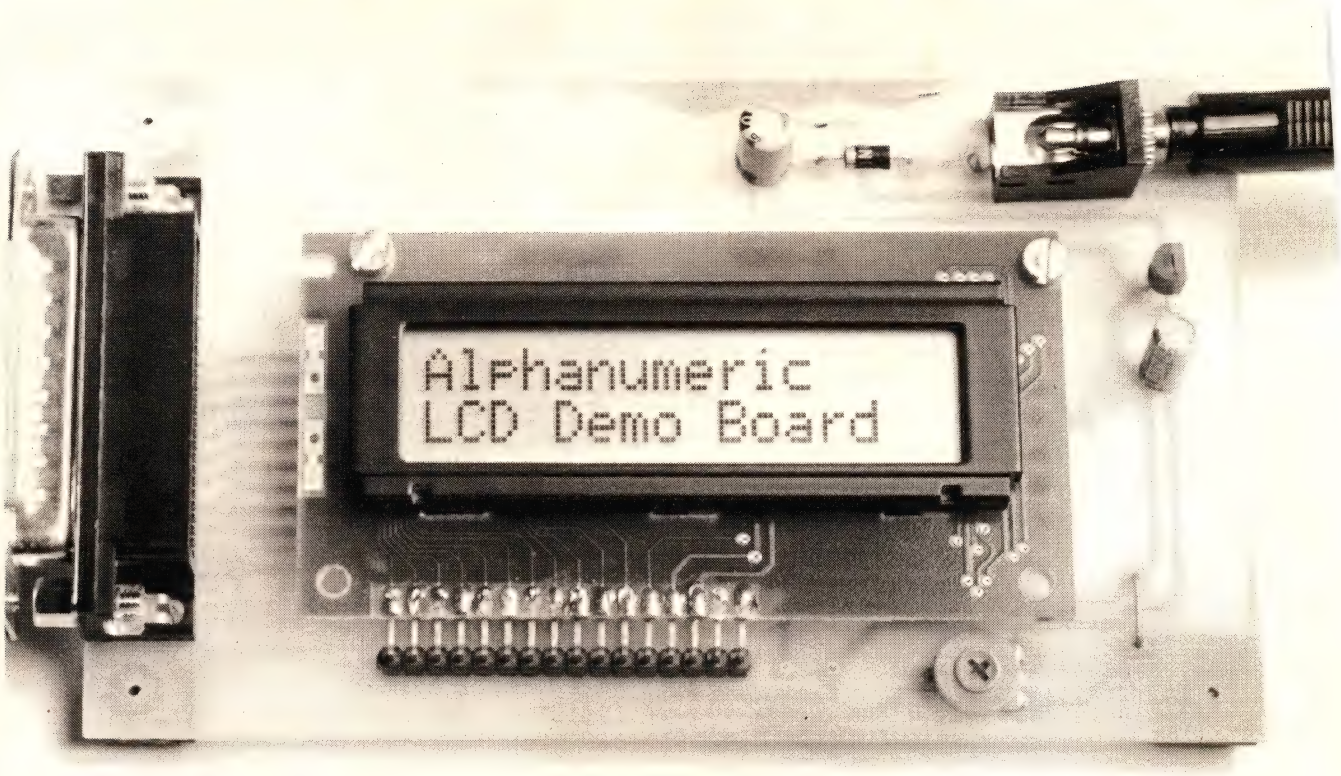


Alphanumeric LCD Demonstration Board

Using an alphanumeric LCD panel is not as hard as you may have thought. In this article, we show you how to interface one to a PC printer port.

By DARREN YATES

Over the last few years, the cost of alphanumeric displays has dropped dramatically. That's hardly surprising, considering they are being used increasingly in consumer goods as the push continues for "smart" appliances.

Most of these displays are controlled by microprocessors and are designed to make complicated equipment easier to operate. Items such as microwave ovens, fax machines, CD players and car stereos now use alphanumeric panels to display options and commands to help the user achieve the desired result.

Alphanumeric LCDs are available in many shapes and sizes but one of the most cost-effective types is the 16 character x 2 line display that's used here. It requires only 11 connections – eight bits for data (which can be reduced to four if necessary) and three lines for control.

It runs off a 5V DC supply and sells for just $35, making it perfect microprocessor-controlled projects.

Circuit details

The LCD module contains two microprocessors and that's about all there is to tell. These can be easily described as the two black blobs on the back of the PC board. Apart from the display itself there's nothing else, it's that compact.

Fig.1 shows the simple circuitry that goes with the display. As you can see, it consists of a power supply which uses a 78L05 100mA 3-terminal regulator to derive a regulated 5V rail. The power is derived from a 9V 300mA plugpack, while D1 provides reverse polarity protection.

Since the display requires only about 1mA of current, this arrangement is more than adequate.

he display contrast is adjusted by ans of a 10kΩ trimpot which feeds oltage into pin 3 of the display. art from that, all you need is a le-to-male DB25 cable to connect display to the PC.

ogramming

Normally, you would expect to see ese displays being driven from a dicated microcontroller but it's ite easy to get the display to work om your PC's parallel printer port. hat's because the display can be eas- y controlled by programming port A r the eight data bits and port C for ie three control lines (note: port A nd port C are both part of the one arallel port).

One thing that should be noted with he printer ports is that the addresses ve've used for port A are 0378 hex 888 decimal) and for port C, 037A ex (890 decimal).

All the pins for port A are non-inverted; ie, if you set a particular bit to "1", then that bit goes high. However, for Port C, we have used the lower three bits and the first two are inverted; ie, to set them high, you need to set that bit to "0", not "1".

The computer program takes care of all this and you don't need to know very much about computing to get the display to work. For those who are interested in how to program it, the computer program contains documentation which shows the programming sequence.

Instructions

OK, let's get down to the business end of things. The first thing to look at is the three control inputs to the display. They are REGISTER SELECT (pin 4), READ/WRITE SELECT (pin 5) and OPERATION ENABLE (pin 6).

The REGISTER SELECT input controls whether you are writing an instruction to the on-board microprocessor (input set to 0), or writing data to be displayed on the screen (input set to 1).

The on-board microprocessor allows for quite a few different effects, such as shifting characters, scrolling the display left or right, and defining your own characters. We'll look more closely at these special effects later.

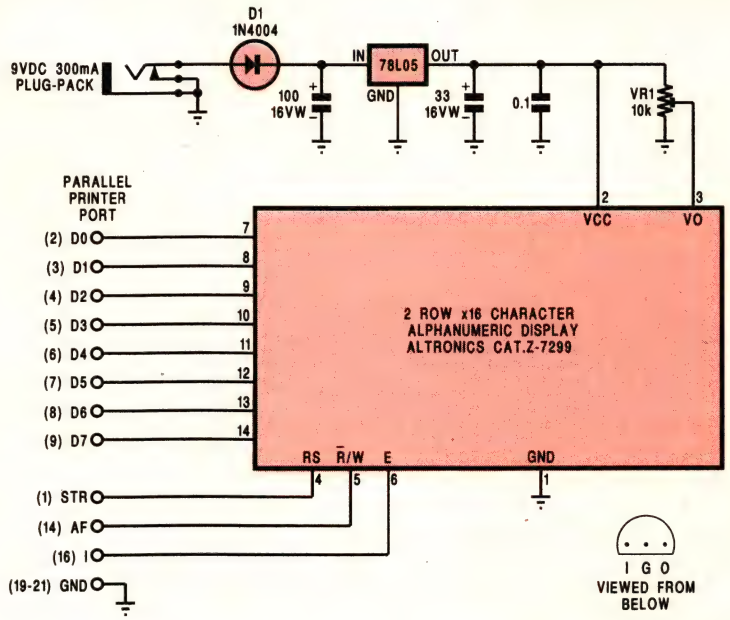
The READ/WRITE select input allows you to read the current address counter and the busy flag status. They are not often used and are not required to operate the display.

The OPERATION ENABLE input is very much like the ENTER key on your keyboard. This pin must be taken high and then low again before the instruction or data is entered in (ie, the operation takes place on the negative going edge of the enable signal).

Table 1 is a quick reference chart of the instructions and the corresponding code.

By using the printer port, you can program the display in just about any language you like, as long as it has an instruction which allows you to send data to the printer port registers.

Let's start by turning the display on. To do this, we initially set port A



ALPHANUMERIC DISPLAY
DEMONSTRATION BOARD

Fig.1: the circuit consists of the alphanumeric display module plus a power supply which uses a 78L05 100mA 3-terminal regulator to derive a regulated +5V rail. The eight display data lines interface to port A of the parallel printer port, while the three control lines interface to port C.

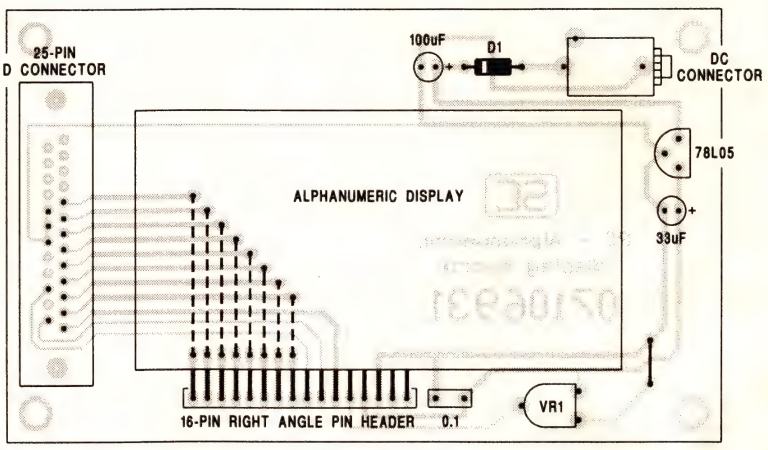


Fig.2: install the links (shown dotted) on the PC board before mounting any of the other parts. The alphanumeric display is connected to the PC board using a right angle pin header which is soldered to the underside of the module.

TABLE 1

Parameter	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Notes
Clear Display	0	0	0	0	0	0	0	0	0	1	
Cursor Home	0	0	0	0	0	0	0	0	1	*	
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	DB1=1: Increment DB1=0: Decrement DB0=1: Display not shifted DB0=0: Display shifted
Display on/off	0	0	0	0	0	0	1	D	C	B	DB2=1: Display on; DB2=0: Display off DB1=1: Cursor on; DB1=0: Cursor off DB0=1: Blinking on; DB0=0: Blinking off
Cursor/ Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	DB3=1: Shifts display one character DB2=1: Right shift; DB2=0: Left shift
System Set	0	0	0	0	1	DL	N	F	*	*	DB4=1: 8 bits; DB4=0: 4 bits DB3=1: 2-line display (1/16 duty cycle) DB3=0: 1-line display
Set CGRAM Address	0	0	0	1	Acg						The maximum address length is 64
Set DDRAM Address	0	0	1	Add							The maximum address length is 80
Read Busy Flag/Address Counter	0	1	BF	AC							DB7=1: Busy (instruction not accepted) DB7=0: Ready (instruction accepted)
Write Data	1	0	Write Data								
Read Data	1	1	Read Data								

to 12, which is DB3 and DB2 set high. Port C is then set to 7 and then to 3 – see Table 1.

Because the first two bits of port C are inverted, we need to set them to 1 to get 0's at the output. Setting this port to 7 pulls the enable input of the display high and then setting it to 3 pulls it low again.

If we are using DOS 5.0's QBasic programming language, the code looks like this:

```
OUT 888,12
OUT 890,7
OUT 890,3
```

If you try this on a 486 machine, you might find that the change from high to low produced by the last two instructions might be too fast for the microprocessor, so a small delay should added in; eg, by using a FOR...NEXT loop.

The display initially boots up in an 8-bit data 1-line mode, so we can start entering characters to be displayed on the screen almost immediately.

One of the best features of this display is that it accepts standard ASCII code. This makes it very simple and versatile to program as it matches the code used in your PC.

For example, let's assume that we want the words SILICON CHIP to appear on the top

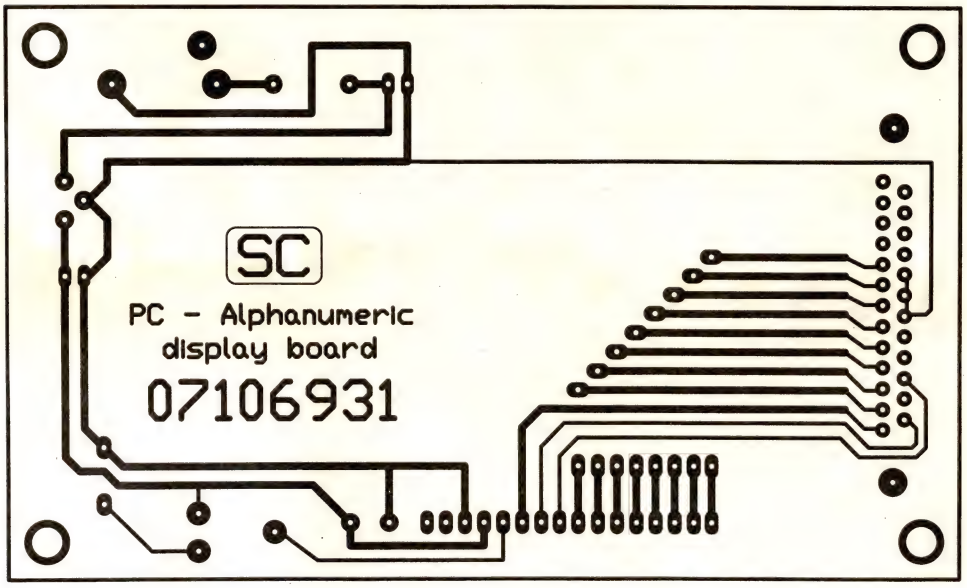
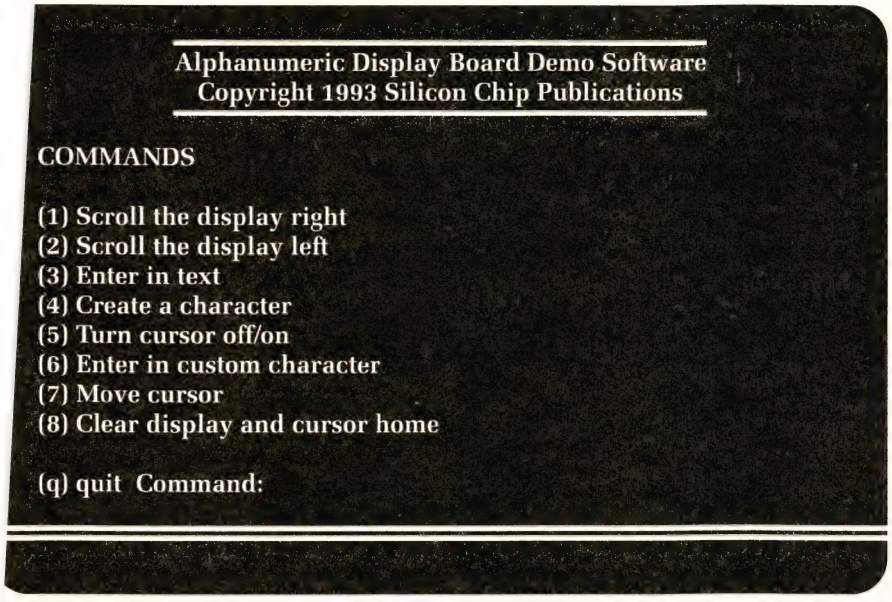


Fig.3: check your PC board for etching defects by comparing it with this full-size pattern before installing any of the parts. The board measures 128 x 77mm (code 07106931).


Alphanumeric Display Board Demo Software
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COMMANDS
(1) Scroll the display right
(2) Scroll the display left
(3) Enter in text
(4) Create a character
(5) Turn cursor off/on
(6) Enter in custom character
(7) Move cursor
(8) Clear display and cursor home
(q) quit Command:

Fig.4: this is the opening menu of the demonstration program LCD.EXE. By selecting the appropriate number & pressing <enter>, you can enter in text, scroll the display left or right, & create custom characters.

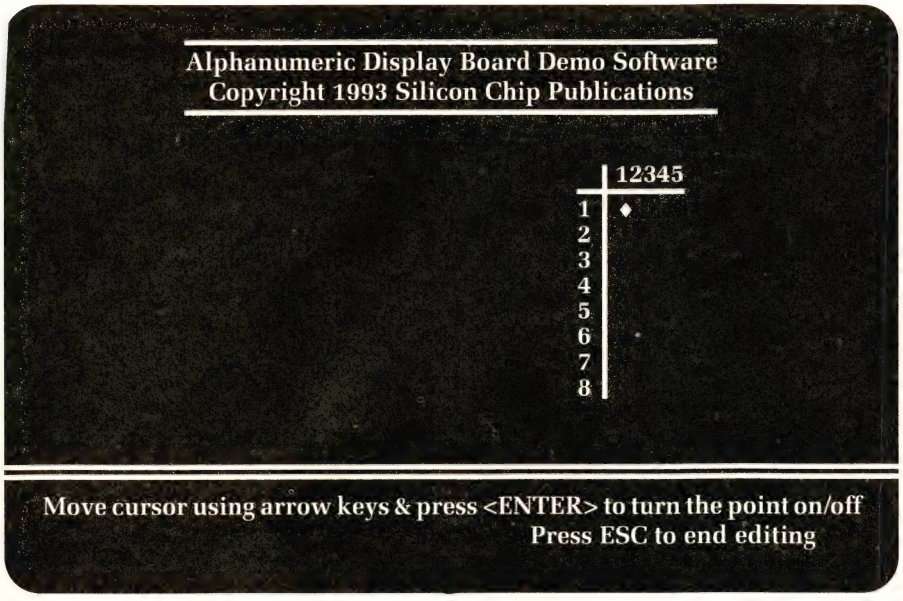


Fig.5: this on-screen display is brought up by entering <4> <enter> at the opening menu. It allows you to create custom characters by moving the cursor to a desired point using the arrow keys & then pressing <enter> to turn that point on or off.

line. The ASCII code for an "S" is either 83 decimal or 53 hex. We don't have to program in hex so we can just use the decimal code.

To display the "S", the code would look like this:

```
OUT 888,83
OUT 890,6
FOR D = 1 TO 10: NEXT D
OUT 890,2
```

Notice the difference between this and the last section of code. Because we are now entering data and not instructions into the display, the REGISTER SELECT line is taken high (remember the inversion).

The FOR..NEXT loop adds in a delay to make sure that all lines have settled into their final state before we enter the code.

The next letter to be entered is "I". This has an ASCII code of 73 and is entered in exactly the same manner as the "S" except that we now substitute 73 for 83.

Each character code is entered into one of 80 memory locations to give two lines of 40 characters. Because only 16 characters per line can be displayed at any one time, there is an instruction which allows us to scroll the display to either the left or the right.

The code for shifting the display one character to the right is 28, while the code for shifting it to the left is 24 – see Table 1.

For this project, the basic rule is that if you're entering a command, then you must toggle port C (that's address 890) to 7 and then back to 3. If you're entering data into the display, you have to toggle it to 6 and then back to 2.

Each time you execute a shift command, the display is shifted one character in that direction. So in order to scroll the display, you have to enter the code in as many times as you wish to move characters. If you do it indefi-

PARTS LIST

1 PC board, code 07106931, 128 x 77mm
1 9VDC 300mA plugpack
1 DB25 female right-angle PCB mount connector
1 3.5mm PCB mount socket
1 single way right-angle pin header
2 5mm untapped spacers
2 3mm x 9mm machine screws & nuts
4 rubber feet
1 10kΩ trimpot
1 demonstration program (LCD.EXE) – see below

Semiconductors

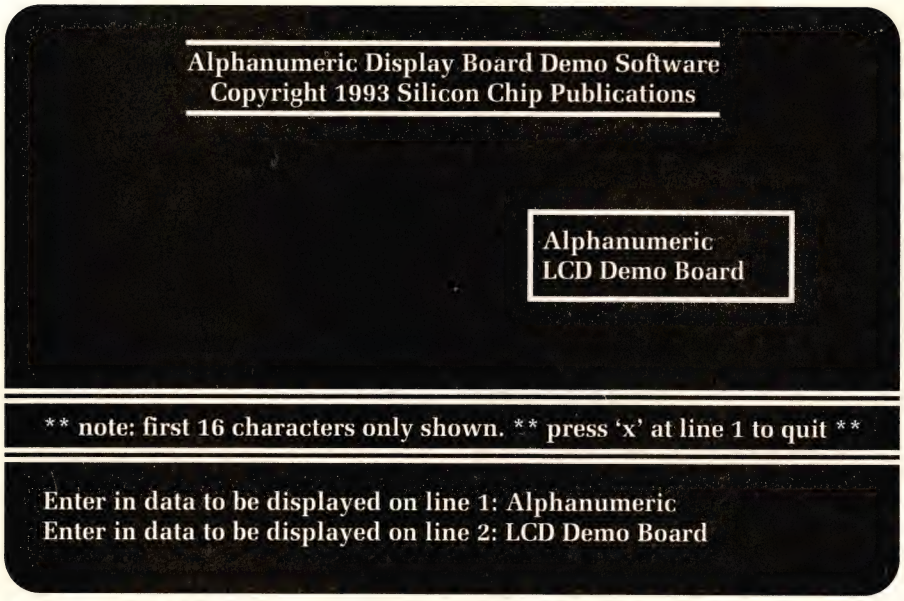
1 2 row x 16 character alphanumeric display (Altronics Cat. Z-7299)
1 78L05 5VDC 100mA regulator
1 1N4004 diode (D1)

Capacitors

1 100µF 16VW electrolytic
1 33µF 16VW electrolytic
1 0.1µF 63VW MKT polyester

Where to buy the software

The demonstration program LCD.EXE & the source code LCD.BAS can be obtained by sending $10 plus a formatted 5.25-inch or 3.5-inch floppy disc to: SILICON CHIP, PO Box 139, Collaroy Beach, NSW 2097.


Alphanumeric Display Board Demo Software
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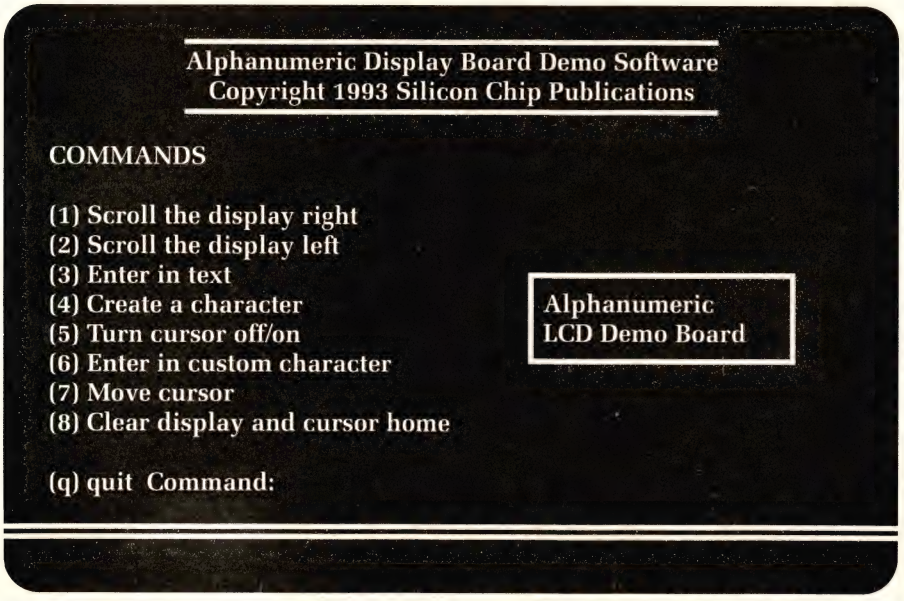
Alphanumeric
LCD Demo Board
** note: first 16 characters only shown. ** press 'x' at line 1 to quit **
Enter in data to be displayed on line 1: Alphanumeric
Enter in data to be displayed on line 2: LCD Demo Board

Text is entered by pressing <3> <enter> at the opening menu & then typing in the required message. Note that the on-screen text window only shows the first 16 characters of each line, although up to 40 characters can be entered.



Pressing the <enter> key after the second line of text has been entered returns you to the opening menu. The text can be cleared by pressing <8> <enter>.

nitely, then the display will scroll across the screen continuously.

Character generation

The display has a character set which contains 240 different characters but for those who want to "roll their own", there are eight custom characters which can be programmed into the display.

To make this easy, our demonstration program (LCD.EXE) has a character generation table built in which allows you to turn any one of the 8 x 5 dots in the character on or off. The program then enters the data into one of the eight special character RAMs.

To explain briefly how this works, if you refer to Table 1 you will see the instruction SET CGRAM ADDRESS. After bit DB6 has been set high, you can set the CGRAM address counter to one of 64 addresses. The first eight addresses correspond to the eight rows of the first character, the next eight addresses to the eight rows of the second character, and so on, up to a maximum of eight characters.

Once a character address has been set, the data then entered represents which of the five dots in that row to be on and off. Each bit that is se 1 represents a dot that is on. Aga each row data entry must be follow by port C being fed with 6 and 2 enter it in. This means that it take series of eight instruction sets to c ate one character.

This character is then stored memory and can be recalled for d play by entering 0 through to 7 f each of the eight characters; ie, OU 888,0 for character 1; OUT 888,1 f character 2, etc.

Construction

All of the components for the A phanumeric Display Demo Board ar installed a PC board coded 0710693 and measuring 128 x 77mm.

Before you begin construction, mak sure that all the tracks on the PC boarc are OK and that there aren't any de fects such as shorts or breaks. If you find any, use a small artwork knife or a small blob of solder where appropriate to fix the problem.

The first job is to solder a 16-way right-angle pin header to the edge connector of the display board – see photo. This done, install the 3.5mm socket, the 3-terminal regulator and other components as shown in Fig.2. The PC-mount DB25 socket can then be installed on the board, followed by the LCD module itself.

The top of the LCD module is supported on two 5mm spacers and secured using machine screws and nuts. Use the mounting holes at the top of the module as guides when drilling the mounting holes in the PC board.

Software

As mentioned earlier, a demonstration program (LCD.EXE) plus the source code (LCD.BAS) to go with this project are available from SILICON CHIP (see parts list for details).

LCD.EXE allows you to produce all the effects described in this article and is started by typing LCD<enter>. The main command screen is then displayed and this provides a menu of all the possible commands. The software is very straightforward to run and requires no knowledge of how the LCD panel works to get it running.

The source code provided runs under DOS 5.0's QBasic. Its main aim is to give experienced programmers a chance to customise the software to suit their own requirements. **SC**

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Transmitter Specifications

Supply voltage: 6-12V

Current consumption @ 9V: 3.5mA

Pre-emphasis: 50uS

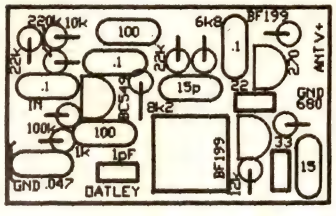
Frequency response: 40Hz to greater than 15KHz

S/N ratio: Greather than 60dB

Sensitivity for full deviation: 20mV

Short term frequency stability (see notes): 0.03%

PCB dimensions: 26mm X 42mm. Full size PCB overlay is shown below.



Construction is easy and repeatable results are obtainable, since no coil winding is necessary. A variable inductor is provided already assembled in a shielded metal can. The double sided and solder masked PCB also makes for very easy construction.

The kit is supplied with a printed circuit board and all the on-board components, a high sensitivity omnidirectional electret microphone, and a 9V battery clip.

THE TOTAL COST OF THE KIT IS $11 ea.

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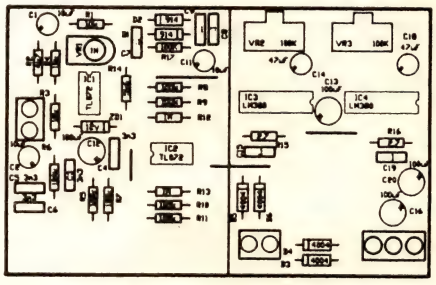
X–Y LASER SCANNER KIT

You could spend thousands of dollars buying commercial X–Y scanners for laser beam deflection. This X–Y scanner compromises by employing two suitable DC motors to achieve good results. With normal levels the motors don't actually spin but simply vibrate around the set position.

The PCB and component kit include rectification and filtering (power supply), audio preamplifiers, audio filtering, and two separate power amplifiers to drive the two deflection motors. The scanner is powered by a 16V AC–900mA plugpack.

In one of the modes of operation the scanner can produce a totally random two dimensional display which is depended on the actual music picked up by the electret microphone. A second mode of operation enables the power amplifiers to be driver from external oscillators and/or pre-taped signals recorded on a stereo cassette recorder.

A short form kit of parts is available for the X–Y scanner. It includes a screened and solder masked PCB and all the on-board components, an electret microphone, two motors, and two lightweight mirrors.



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240V–16V/900mA AC-DC Plugpack $16 extra.

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By FLAVIO SPEDALIERI

Build this low-cost mini gas laser

Here's your chance to build a small gas laser pointer for $60. It runs off a 7.2V battery power supply & uses a pre-built inverter module.

If you've ever been to a conference or to a lecture, you may have noticed the speaker using a laser pointer to indicate something of importance on an overhead projector.

Laser pointers are a great idea because they allow so much more flexibility than before. No longer do you have to stand near the screen to point out something, thereby blocking off the view to half of the people in the audience.

In the past, however, the price of laser technology has been pretty steep. But now you can build your own laser pointer for about $50.

This project uses a small gas laser, a pre-built voltage inverter module and a compact voltage quadrupler to produce an EHT voltage of about 5kV (before the tube strikes). It can be built into a length of electrical conduit and used as a laser pointer, or built into a plastic zippy case for experimental work.

Circuit details

Let's take a look at the circuit for the Gas Laser – see Fig.1. The voltage inverter module, based on Q1, Q2 & T1, comes ready-assembled on a small PC board.

Transistors Q1 and Q2, together with T1, form a complementary switching oscillator with feedback to the transistor bases provided via a separate winding on the primary side of the transformer. It oscillates at about 20kHz or so and steps up the 7.2V DC input to approximately 900V AC.

This high voltage AC signal is fed to a Cockcroft-Walton voltage multiplier circuit comprising diodes D1-D5 and their associated capacitors. The resulting EHT appears at the cathode of D5 and is fed to the anode of the laser tube via two ballast resistors (82kΩ and 33kΩ). When the circuit is first turned on, the Cockcroft-Walton voltage multiplier produces a voltage of about 5kV to fire the laser tube and establish a discharge current of several milliamps through it.

Once the discharge current is flowing, the Cockcroft-Walton multiplier can no longer function properly because its high impedance is heavily loaded by the laser tube. This high impedance is artificially provided by the 1MΩ resistor and the 33pF capacitor. So what happens is that the inverter circuit supplies the laser tube via the series path provided by diodes D1-D5.

Even so, the voltage across the laser tube is still quite high, at close to 1000 volts DC. The current through the tube is set by the ballast resistors.

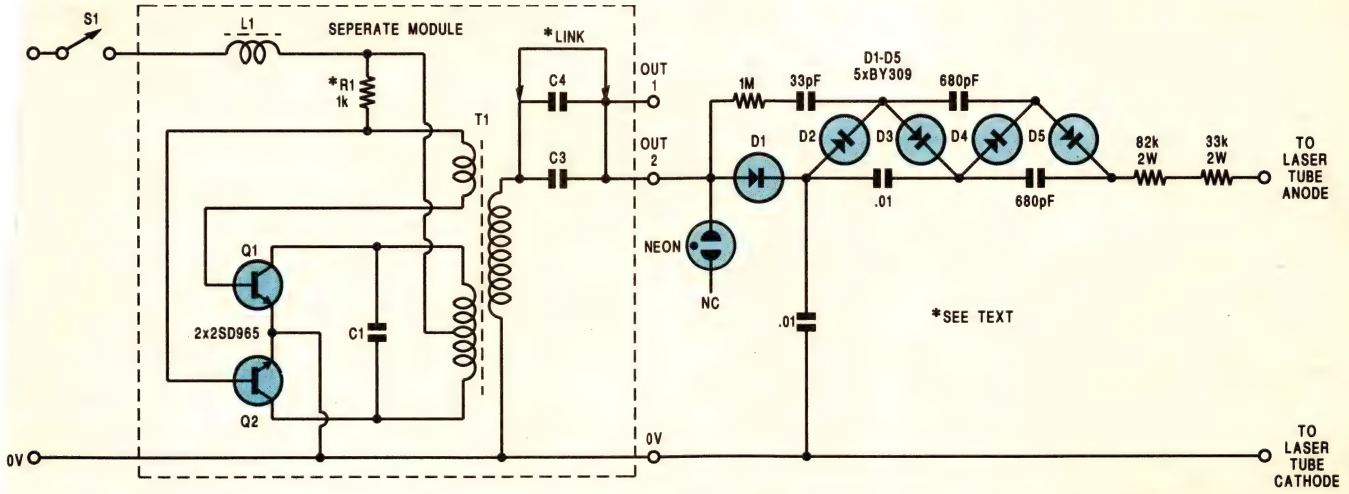
Construction

Before starting the construction, there are a couple of modifications to be made to the inverter module. First, the 240Ω resistor (R1) at one end of the board (next to the two transistors) must be removed and replaced with a 1kΩ resistor. This will reduce the over-

DANGER!

(1). Looking directly into the laser tube while it is operating could damage your eyesight. Although the tube only has an output of 0.5mW, the concentrated nature of the laser light can damage the retina. Never look into the tube while it is operating – ever.

(2). The power supply in this project is capable of giving a severe electric shock. It contains a DC-to-DC converter which steps the voltage up to very high levels. Never work on the circuit while power is applied. In fact, don't even trust the circuit after the power has been disconnected, since the high voltage capacitors can retain a substantial charge for quite some time.



LASER POWER SUPPLY

ig.1: the circuit uses a pre-built DC-DC inverter stage to step up the battery oltage to approximately 1000V AC. This signal then drives a Cockcroft-Walton oltage multiplier circuit based on diodes D1-D5 & their associated capacitors.

ll current consumption of the cir-uit. Second, capacitor C4 (33pF) must e removed from the board and re-placed with a wire link (note: this capacitor can subsequently be used on the multiplier board). Capacitor C3 can be left in circuit, even though it serves no useful purpose.

Once these changes have been made, the voltage multiplier board can be assembled – see Fig.2. Begin by installing the five EHT diodes. Note that the cathode end of these diodes is indicated by a purple band on one lead (not the body) and that D2-D5 have to be mounted end on in order to fit.

Note also that if you try to check these diodes using a multimeter, you will not get a result. That's because the forward voltage of these diodes is quite high at about 3V. The best way to check one of these diodes is to wire it in series with a 9V battery and a 4.7kΩ limiting resistor and then measure the voltage across it.

Don't substitute for the diodes since they are a special high-voltage type which is rated at 12kV. The five disc ceramic capacitors are also high voltage types rated at 3kV and can be installed at this stage. Finally, install the 82kΩ ballast resistor, then mount the inverter board on top of the rectifier board by installing three "pin-through" connections.

Final assembly

The wiring between the board assembly, the tube and the other items of hardware can now be completed as shown in Fig.2. Note that one end of the 33kΩ ballast resistor is soldered directly to one of the tube clips.

If you wish to make a laser pointer, the circuitry can be installed inside a 300mm length of 40mm OD electrical conduit. This is fitted at either end with 10mm-thick Perspex end plates. One of these, at the laser end, has a 10mm-diameter hole drilled through it to allow the laser light to escape.

The other end plate carries a DC input socket, to match the one on the battery pack (note: Fig.2 shows banana style input sockets, as used in the zippy case version). A hole also needs to be drilled in the conduit at this end for a pushbutton on/off switch, with an additional hole in front of it to accept the neon indicator.

The laser tube and its companion PC board are a comfortable fit into the conduit. Before they are installed though, you will need to pack some pliant insulating material, such as corrugated cardboard, around the laser tube so that it is centrally located in the conduit.

Important: be sure to install the tube the right way around. The tube specified emits light from its cathode end (ie, from the end opposite the 33kΩ ballast resistor), so make sure that this end goes towards the hole in the end plate.

Alternatively, you can mount the tube and PC board assembly on the lid of a plastic zippy case, as shown

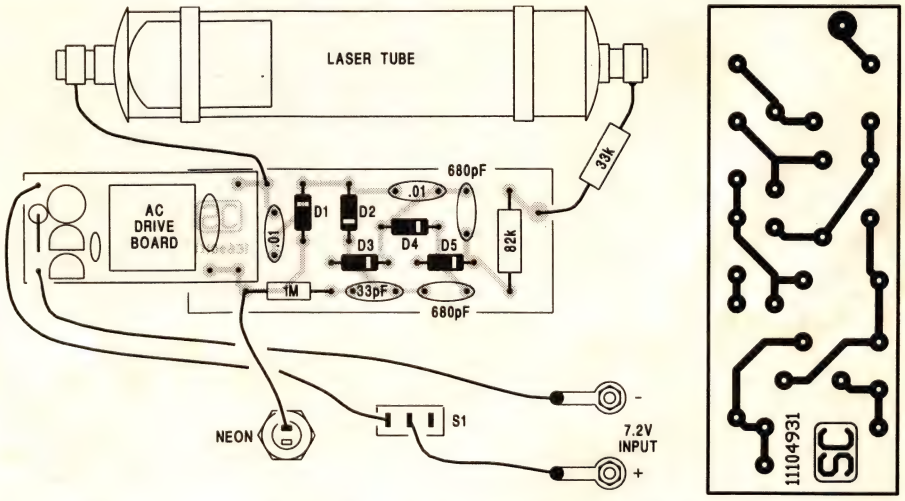


Fig.2: before installing any parts, remove capacitor C4 from the inverter (AC drive) board & substitute a wire link. Note that the completed multiplier board assembly should be potted in neutral cure silicone sealant to reduce the possibility if arcing & accidental electric shock. Fig.3 at right is the full-size artwork for the multiplier PC board.

in the photos. To mount the tube, you'll need two cable tie mounts with adhesive bases. Attach these bases to the lid in the appropriate positions, then loop two plastic cable ties through these bases and around the tube.

Pull the cable ties up firmly but don't make them too tight or you could fracture the tube. The board assembly can be attached to the lid using a suitable epoxy adhesive. After that, it's simply a matter of wiring up the on/off switch, neon indicator and power supply sockets. A rocker-style on/off switch can be used for this version.

Power for the laser can be derived from a 7.2V nicad battery pack (or six 1.2V cells in series), or you can run it from a mains supply capable of supplying 7.2V at 1A.

Initial testing

Check your work carefully and make sure that the unit is fully enclosed in its case before applying power. The unit should fire up immediately when the battery is connected. If not, disconnect it and individually discharge each high-voltage capacitor using a well-insulated clip lead. Remember, they can give you a substantial shock, even if no power is app to the circuit.

Once the capacitors have been charged, you can safely check y work and rectify any mistakes. T done, it's a good idea to pot the hi voltage capacitors and diodes in n tral cure silicone sealant. This w help prevent arc over and also p vides a further degree of protecti against accidental contact with hig voltage components.

Finally, be sure to **attach a warni label to the unit**, advising of the da gers of direct eye exposure (see war ing panel). Suitable warning labe are available from the supplier liste at the bottom of the parts list. S

PARTS LIST

1 PC board, code 11104931, 66 x 25mm
1 DC-DC inverter module
1 0.5mW laser tube
1 on/off switch to suit – see text)
1 300mm length of 40mm OD electrical conduit (optional – see text)
2 10mm thick Perspex end plates (optional)
1 DC socket (optional)
1 plastic zippy case, 130 x 68 x 41mm (optional)
2 banana sockets (1 red, 1 black – optional)
4 rubber feet for zippy box (optional)
6 AA size nicad cells
5 BY509 high-voltage diodes

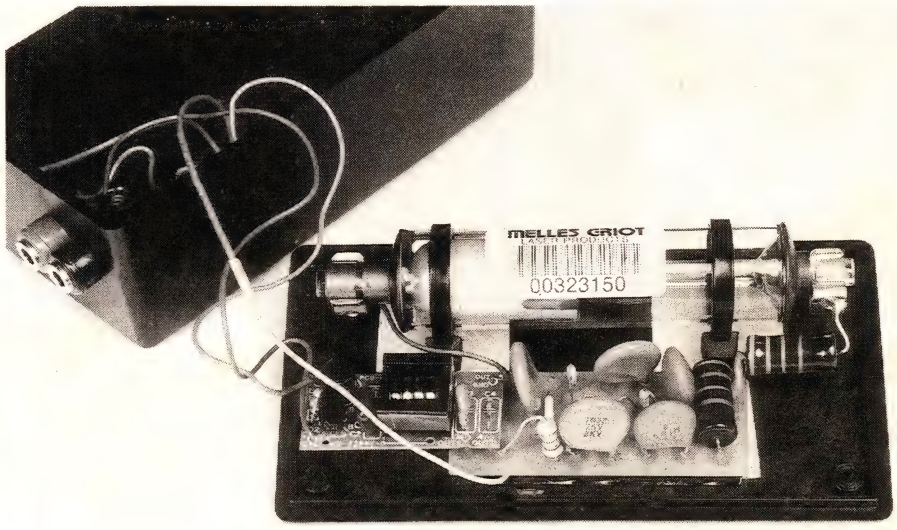
Capacitors
2 .01µF 3kV ceramic
2 680pF 3kV ceramic
1 33pF 3kV ceramic

Resistors (0.25W, 5%)
1 1MΩ
1 33kΩ 2W
1 82kΩ 2W
1 1kΩ

Miscellaneous
Hook-up wire, plastic cable ties & cable tie mounts (see text), neutral cure silicone sealant.

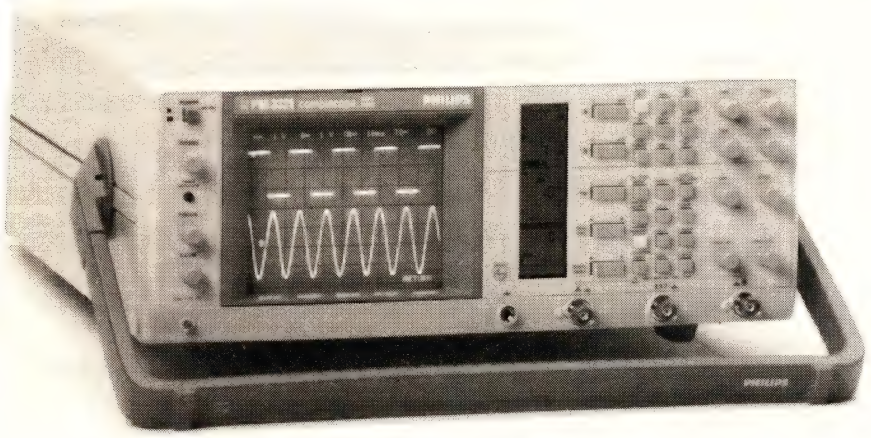
Where to buy the parts
Parts for this project are available from Oatley Electronics, PO Box 89, Oatley, NSW 2223. Phone (02) 579 4985. The laser tube sells for $35, while the inverter module, multiplier PC board & high voltage components are $15 (includes warning label). Please add $5 for p&p.

The laser tube is secured to the lid of the case using two cable ties & two plastic mounts with adhesive bases. Note that this tube emits from the cathode end (ie, the end opposite the ballast resistors).



A laser pointer can be made by sliding the tube & the PC board assembly into a length of 40mm OD electrical conduit. Pack some pliant insulating material, such as corrugated cardboard, around the laser tube so that it will be centrally located in the conduit. Be sure to fit a warning label to the case (see text).

PRODUCT SHOWCASE



New analog/digital scope from Philips

The new PM 3331 Combiscope® has a 40MHz analog bandwidth and a 20 megasample/second sampling rate. The sampling rate is specified for operation on both channels simultaneously and a large acquisition memory of 8Kb. This ensures excellent resolution of the captured signals, allowing detailed analysis of complex waveforms.

An additional 8Kb register allows the waveforms to be stored for reference and comparisons.

The PM 3331 has microprocessor controlled features such as AUTOSET which sets sensitivity, timebase and triggering on both channels, in both ANALOG and DIGITAL STORAGE modes. In addition, the DIGITAL STORAGE mode allows cursor measurements on captured waveforms, with on-screen numeric readout of the values between the cursors, making it easy to get precise values of amplitudes, frequencies and time intervals.

Hard copy output of stored waveforms is enabled by the PM 3331's RS-232 serial port, which can be connected to either a plotter or a dot matrix printer. This facility allows displayed waveforms, including cursors, measurement readouts and other on-screen information, to be printed out for reference or visual comparison, as well as for archiving or publication.

For further information, contact Philips Test & Measurement, 34 Waterloo Rd, North Ryde, NSW 2113. Phone (02) 888 8222.

Digitiser tablets for PCs

Genius Australia has released a new range of high resolution digitiser tablets for DOS and Windows-based PCs.

The HiSketch 906 is a 220 x 150mm digitiser with .01mm accuracy. It includes a 3-button smart stylus for freehand rendering in desktop publishing and has a retail price of $344.00.

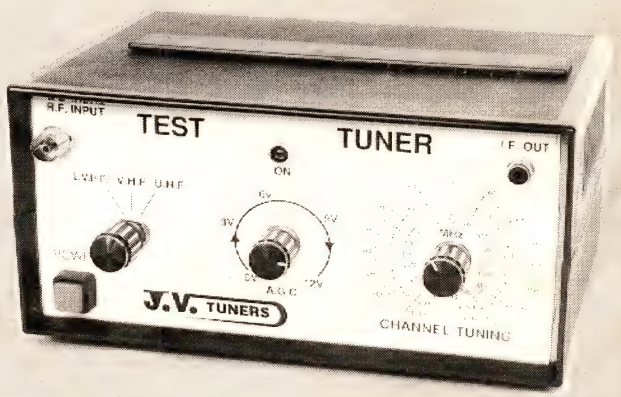
The HiSketch 1212 has a 300 x 300mm drafting surface and incorporates a 3-condition LED display, a slim stylus and precision puck. It retails for $756.00.

TV test tuner for servicemen

This test tuner will be a boon for servicemen handling front-end problems when servicing TV sets. It will enable much easier diagnosis of problems like tuner drift, low gain, incorrect AGC and so on. It continuously covers the VHF and UHF range of Australian sets and has its own mains power supply which will simplify connection to the set under test.

Also provided is an adjustable external AGC voltage which can help in diagnosing AGC problems in the IF stage of the set.

Front panel controls are a power switch, 3-position bandswitch, AGC output control and the channel tuning knob which has three scales calibrated in megahertz. The tuning range is from 40MHz to 1400MHz. On the lefthand side is a Belling Lee socket for 75Ω coax connection, while an RCA socket on the righthand side provides the IF output.



Recommended retail price of the Test Tuner is $250 including sales tax, plus $10 for postage and packing. At this price, it must be rated as a bargain.

For further information, contact John Connerly at J. V. Tuners, 216 Canterbury Rd, Revesby,

New hifi range from Quad

Amber Technology has been appointed exclusive Australian distributor for the Quad range of audio products. Quad's hifi products include preamplifiers, a compact disc player, power amplifiers, FM tuners and, of course, their famous electrostatic loudspeakers.

The Quad 66 preamplifier and CD player are very compact and easy to use. The two units are operated from a separate IR remote panel which has large controls and simple function labelling. The preamplifier controls volume, tilt, bass step, balance, filters, input selection and stand-by. A total of seven inputs is provided, allowing the connection of virtually any program source.

The Quad 306 and 606 power amplifiers use an identical circuit design, the only difference being power output. According to Amber, the Quad 306 provides superb performance with sufficient power to meet the requirements of most domestic systems, while the Quad 606 provides enough power for the most demanding systems.

Quad hifi products are available from selected audio retailers. For further information, contact John Fitzpatrick, Amber Technology, Unit B, 5 Skyline Pl, Frenchs Forest, 2086. Phone (02) 975 1211.

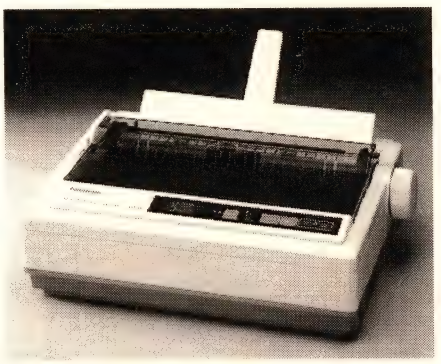
The HiSketch 1812 450 x 300mm digitiser is intended for use by engineers and artists. The large workspace allows users plenty of room to design and modify graphics with pinpoint accuracy. Genius' proximity sensing function also enables precise tracing from 25mm above the tablet's surface. The model includes a slim stylus, precision puck and an LCD panel which displays cursor coordinates. Its retail price is $1050.00.

The Genius HiSketch range emulates mice from Microsoft and Mouse Systems and all come complete with a stylus pen, keyboard adaptor, AutoSketch 2.0 and Microsoft Pen for Windows, as well as Windows and ADI drivers. The top two models also include a precision puck for more intensive applications.

For further information, contact Genius Australia, 4 Briar St, Fulham Gardens, SA 5024. Phone (08) 356 7337 or fax (08) 235 1756.

Panasonic's new dot matrix printer

This new 24-pin dot matrix printer from Panasonic offers ease of use with a new setup program on disc which allows the user to change all printer settings via the computer screen.



Paper handling is also made easy with a flat pin belt, push tractor feed for continuous forms (original plus up to three copies), A4 landscape printing, auto paper load, paper park, tear-off and optional sheet feeder. The parallel port has been moved to the front left side to leave a clear path for the paper feed area, away from the printer cable. This also makes cable connection quick and easy.

The KX-P1121 offers six built-in fonts with a maximum printing speed of 240cps (characters per second) in draft mode and 64cps in letter quality mode. The standard memory of 14Kb is expandible to 46Kb to reduce the time the computer is tied up when a print job is running.

Recommended retail price inc ing tax is $469, while the optic sheet feeder is only $139. For furt information contact Panasonic A tralia, 1 Garigal Rd, Belrose, N 2085. Phone (02) 488 7122.

Nilsen takes over Elmeasco Instruments

Nilsen Instruments has signed agreement to take over the business Elmeasco Instruments Pty Ltd. Nils Instruments is one of Australia's la est test and measurement compani with offices in Adelaide, Brisban Melbourne, Perth and Sydney. Nils Instruments has always been stro in test and measurement and mo recently, with the acquisition of Pa ameters, in the data acquisition an ATE fields.

All the product lines currently har dled by Elmeasco will be transferre to Nilsen Instruments, together wit the sales and support staff.

For further information, contac Nilsen Instruments Pty Ltd, 150 Ox ford St, Collingwood, Vic 3066. Phon (03) 419 9999.

New battery eliminators from Avico

A new company has commenced operations to service the burgeoning market for audio, video and computer accessories. Founded by long-time industry stalwart Tom van der Meyden and backed with key staff experienced in this field, the new company is named Avico Electronics Pty Ltd. The name "Avico" is a contraction of the terms Audio, Video and Computer.

Avico already has a wholesale catalog with over 400 items in stock. Their first product release is a range of new battery eliminators (plugpacks) especially designed to meet Australian safety standards and yes, they are fully approved.

Apart from the functional styling which makes them easy to hold and plug in, the new battery eliminators have a number of features not found on competing designs. First, they have a LED power indicator which shows that they are on. This is an excellent idea – how many times have you left a plugpack on for days at a time?

Second, the 6-way voltage selector, which provides preset voltages of 3, 4.5, 6, 7.5, 9 and 12V, is on the plug

ide so that once it is set and plugged n, there is no chance of little fingers iddling with the switch and possibly lamaging equipment.

The eliminators are also designed o sit upside down when plugged in. This means that they can be used in loor-mounted sockets which would otherwise prevent their use.

Finally, the eliminators come with a full selection of DC adaptor plugs which will suit Japanese audio equipment such as personal radios and portable CD players.

All told, there are seven units in the range, with ratings of 300mA and 500mA, in both regulated and unregulated forms. The range includes fixed voltage (12V) 300mA and 500mA units, and a 12VAC model.

Prices range from $14.95 for the AC model to $19.95 for the 12V models, and from $22.95 to $39.95 for the variable models, depending on their current rating and whether they are regulated or not.

For further information, contact Avico Electronics Pty Ltd, 4/163 Prospect Hwy, Seven Hills, NSW 2147. Phone (02) 624 7977 or fax (02) 624 7143.

Training videotape for electronics

UCANDO computer animated training videos for electronics and computer students are now available. The company now has a complete series of 12 videos, each of which run for about one hour. By the time the student has completed these 12 videos, he or she will have a good basic knowledge of electronics and computer hardware theory.

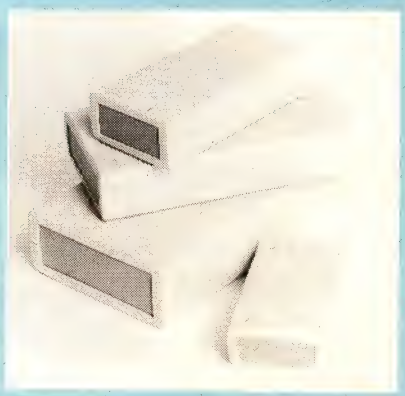
UCANDO videos are produced in the USA and converted to PAL format by UCANDO VCR Educational Products Co, PO Box 4603, Christchurch, 8015, New Zealand. Their phone number is (643) 3 795 5570

New instrument cases from Rod Irving

These new plastic instrument cases will fill a need where something a little more presentable than the standard plastic Jiffy or Zippy case is wanted. They come in two halves and with captured front and rear panels. Inside, they have three slots for vertical mounting of PC boards and small integral pillars in the top and base so that boards can be mounted horizontally as well.

A good quality feature is the use of brass thread inserts in the four pillars for the screws which hold the cases together. All told, there are 12 cases available and their prices range from $4.95 for the smallest case, which measures 90 x 15 x 16mm, to $16.95 for the largest, which measures 190 x 100 x 80mm.

Also available is a range of six waterproof cases with clear polycarbonate lids with O-ring seals. They range in price from $8.95 to $24.95.



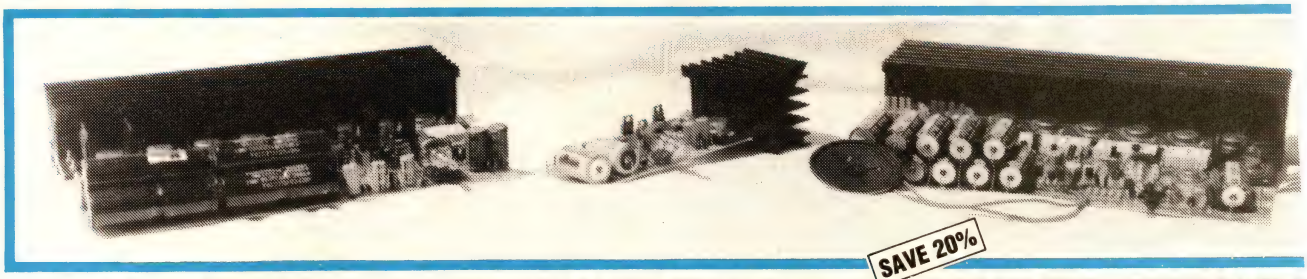
For further information, see the full range of cases at your nearest Rod Irving Electronics store.

PC-based EPROM programmer

Intended as an inexpensive alternative to a stand-alone programmer, the PC-based Model 1880 from Minato Electronics Inc converts a standard PC/XT/AT or compatible into a smart EPROM programmer. It consists of a universal programmer unit, PC adapter card, system interface cable and system diskette, and it requires a host IBM PC/XT/AT or compatible with at least 512Kb of RAM.

1200 device types, including PROMs, E/EEPROMs, PALs, GALs, FPLAs, FPLSs, PEELs, FPLDs, MACHs and microcontrollers can be programmed via a 40-pin standard ZIP socket. Device selection by type and manufacturer is all done from the menu. There is also a full screen editor for fuse map and memory buffer editing. A JEDEC standard vector test is provided and all 40-pin drivers are self-tested with a diagnostic program.

For further information, contact Anitech, 52/2 Railway Parade, Lidcombe, NSW 2141. Phone (02) 749 1244. SC



SAVE 20%

+/- 0-50V 6A REGULATED PSU
S0010 $159.95

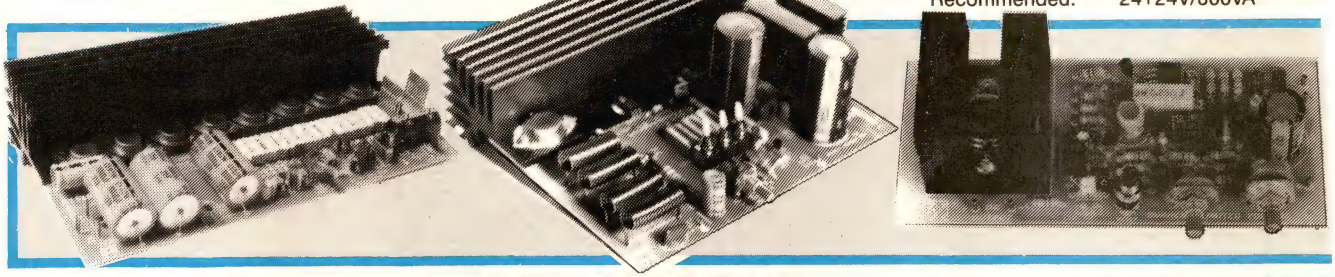
Output voltage:	+- 0-50V DC (+- 0-35V 5A RMS Regulated)
Current:	2A, +2A=4A, +2+2=6A
Overload Indicator:	Current Limit Sharp cut out
Output reset turn the selector to current limit point.	
I/P Transformer:	30-35Vx2 15A 500VA
Recommended:	30+30V/500VA (TO221)

+/-0-35V 2.5A DUAK REGULATED PSU
S0007 ~~$48.00~~ $38.40

Output voltage:	+ 0-35V/0-70V
Current:	2.5A
Overload Indicator:	LED
Protection method:	Current Limited
I/P Transformer:	18-24Vx2/6-8A
Recommended:	22+22V/225VA

0-30V 20A HEAVY-DUTY REGULATED P
S0006 ~~$149~~ $119

Output voltage:	0-32V
Current:	20A MAX
Overload Protection Ranges:	CL/SC
Overload Induced Sharp Cutting Method (	
Overload Induced Current Limiting Method	
Limiting Range:	(Basic) 5A+5A+5A+5A Total 20A
I/P Transformer:	18V-24Vx2/30A
Recommended:	24+24V/800VA



0-20V 20A REGULATED PSU
S0005 $134.00

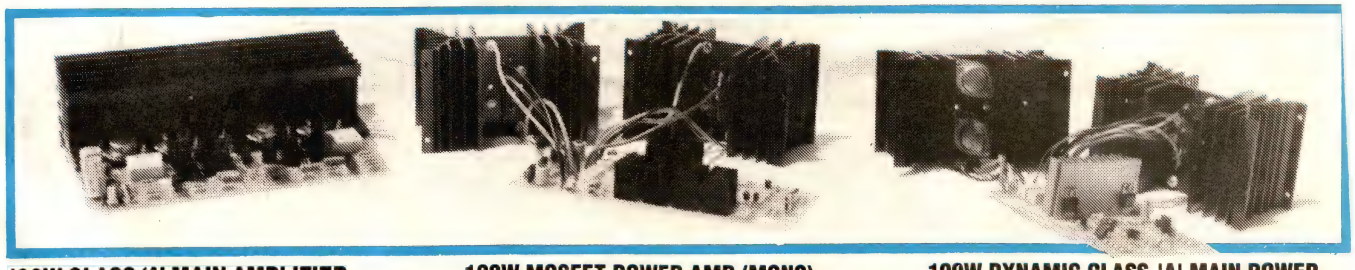
Output voltage:	0-20V
Current:	20A Max
Overload Protection Ranges:	(CL/SC)
(Basic) 5A+5A+5A+5A Total 20A Switch Setting.	
I/P Transformer:	12V-18Vx2/30A
Recommended:	18+18V/500VA

6.5V TO 18V DC REGULATED PSU
S0011 $149.00

Output voltage:	6.5V to 18V DC (25V Max) Fully adjustable
Output Current:	20A Max
Current limit control:	4 Steps (5A,10A,15A,20A)
Ripple and noise:	15 mV
Line Regulation:	0.08% + 20mV
Load Regulation:	0.08% + 20mV
Input Power:	18 to 20V AC 50-60HZ, 20-30A
Recommended Transformer:	18+18/500VA (T0238-Parallel Secondary)

0-50V 3A PRECISION PSU S0001 $49.00

Output voltage:	0-50V
Current:	0.5 to 3A
Overload Indicator:	LED
Protection method:	Auto shut on overload and short circuit
I/P Transformer:	22V-36Vx2/3A – 50Vx2/3A for High O/P
Recommended:	36+36V/160VA – 45+45V/160VA High O/P



100W CLASS 'A' MAIN AMPLIFIER (MONO)
S0313 $79.00

Power Output:	100W 8 OHM
Frequency Response:	0-100KHz
Input Impedance:	22K.
Input Sensitivity:	0.8V
Supply Voltage:	DC+/-30 -42V(MAX)
Current:	5A
Power Bandwidth:	5-50KHz
THD 1KHz 1W:	0.001%
Transformer:	28Vx2/5A
Recommended Transformer:	30+30V/160VA. (T0209) MONO
Recommended Transformer:	30+30V/300VA. (T0217) STEREO

120W MOSFET POWER AMP (MONO)
S0329 $195.00

Power Output:	120W RMS into 8 OHMS
Frequency Response:	8Hz to 20KHz, +0 to 0.4db
Input Sensitivity:	1V RMS for 120W Output
Power Requirement:	+/- 45 to 55 VDC at 3A Mono 40Vx2/3A/160VA for MONO 40Vx2/6A/300VA for STERO
Recommended Transformer:	40+40V/160VA. (T0212) MONO 40+40V/300VA. (T0219) STEREO

100W DYNAMIC CLASS 'A' MAIN POWER AMP (MONO)
S0310 $89.00

Power Output:	100W RMS into 8 OHM .150W RMS into 4 OHM
Frequency Response:	10Hz to 20KHz
T.H.D.:	Less than 0,008%
TID:	Less than 0.008%
Input Sensitivity:	0.75V – 1V
S/N Ratio:	Better than 80db
Power Supply:	+/-35V TO +/-45V DC
Power Consumption:	3.5A per channel.
Recommended Transformer:	30+30V/160VA (T0209) Mono
Recommended Transformer:	30+30V/300VA (T0217) STEREO

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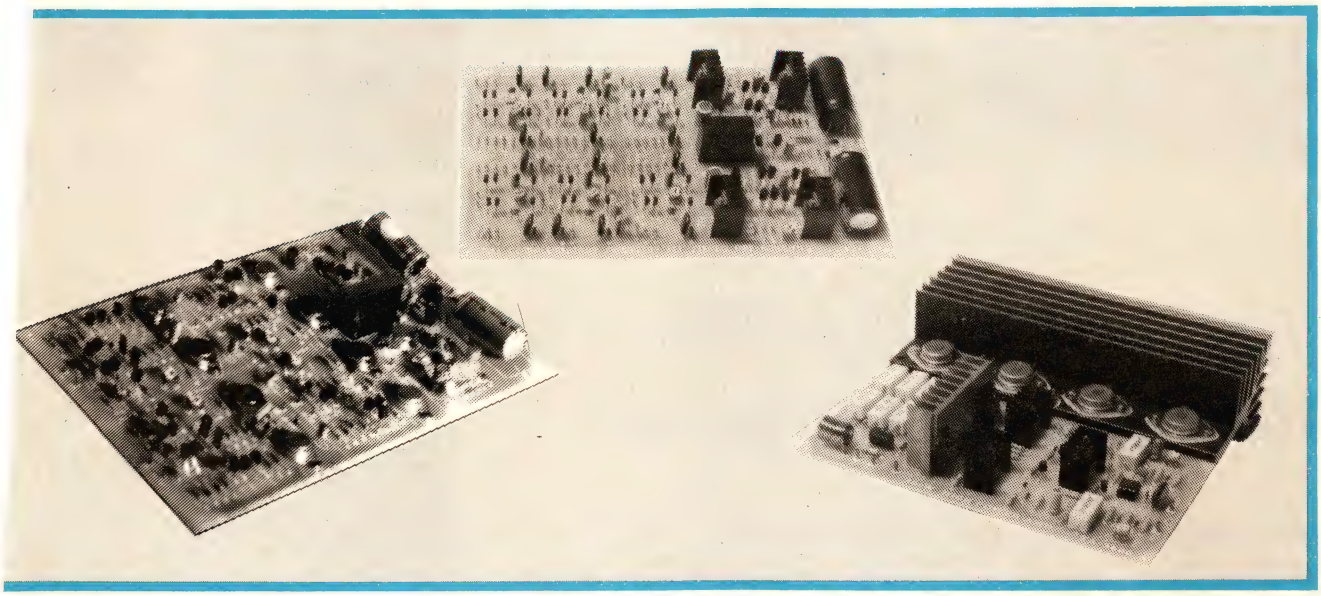

; FET SUPER CLASS 'A' PRE-AMP
S0330 $145.00

equency sponse:	Overall (AUX to pre output) (at rated ouput) 10 to 100,000HZ +0.5-1db
H.D.:	Overall (From AUX) Less than 0.01%
put Sensitivity Impedance:	(1,000HZ for rated output)
hono:	47K OHMS.2mV
utput Level:	Rated Output (0.01% THD)
re-AMP Output:	1.3V (20V MAX. 0.1% THD)
lecording Output:	130mV
nput Power:	36+36V/0.2A
Recommended Transformer:	30+30V/15VA. (T0231)

FULL COMPLIMENTERY SYMMETRY FET STEREO PRE-AMP
S0308 $159.00

Frequency Response:	10 to 100KHz +0.5db -1db
T.H.D. (From AUX):	0.005% at/below rated O/P
Channel Separation	(at rated O/P 1KHz)
Phono:	Better than 70db. HUM & Noise (IHF)
Phono:	Better than 70db.
AUX:	Better than 90db.
Input Sensitivity & IMP.	(1KHz for rated output): Phono 47K OHM,2mV
Output Level:	Rated O/P(0.01% THD). Pre-AMP output 1.5V
Max Output:	(0.1% THD) Pre-AMP output 15V.
Input Power Vol:	AC 30V x 2 400mA
Power Consumption:	12W
Recommended Transformer:	30+30V/15VA (T0231)

300W HI-FI POWER AMP(MONO)
S0331 $175.00

Power Output:	300W RMS into 8 OHMS 500W Music Power into 8 OHMS
Frequency Response:	10Hz to 20KHz
T.H.D.:	Less than 0.05%
I.M. Distortion:	Less than 0.05%
Input Sensitivity:	1V RMS at 47K
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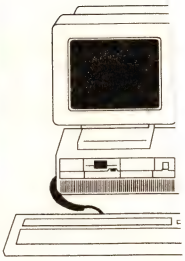
COMPUTER BITS

BY JOE ELKHORNE



Upgrading to a 386 – more on kludging a computer

Last month, I had lots of fun getting the hardware of my cobbled up computer to work. But there was more fascinating frustration to come when I realised how beautifully simple it is to purchase a completely new computer.

The hardware is only half of a platform, of course. Having achieved a working computer, I now had to pursue state-of-the-art software. Fortunately, I'd picked up Windows 3.1 at PC92 at a significant cost reduction – $95 is a lot better than the $225 I'd seen at a discount house when I began this exercise! I also would have bought MS-DOS 5 but they'd sold out. The dealer, however, promised to let me have one from the next shipment at the show price. Good show!

I opened the white box containing the 3.1 goodies and had a quick look at the "Getting Started" booklet. A quick skim gave me enough information to be dangerous and I started the installation. To my dismay, the first problem I encountered was that a CGA driver is no longer provided. Blast! It was pointless to proceed further and I telephoned my friend Graeme.

His suggestion was that we "install" the 3.0 version to get the CGA driver and then install my 3.1 "over the top". That evening, we did exactly that and both discovered how clunky Windows looks on a CGA monitor. Well, it couldn't be helped.

The whole exercise was a process of getting a machine up and running as cheaply as possible. This included using the existing inadequate 40Mb hardcard and the Amstrad CGA monitor. Incidentally, somewhere along the line, an expert told me that said monitor would never work "since they're non-standard". Having heard the "Amstrad's aren't compatible" canard before, I took that with a grain of salt. Empirical tests proved that the monitor did function in a normal fashion – attached to an ordinary CGA card.

One of the curiosities I glossed over earlier was the hardcard installation itself and how we simply ignored the CMOS Setup. Well, since the computer was working, we continued to ignore the anomaly. Having dropped into a slot and found that it worked regardless of the CMOS Setup report there were more important matters to attend to. Since normal disc operations (including defragging) worked the system obviously was happy to recognise it.

Despite the limitations of the CGA monitor, we completed the Windows 3.1 installation. There were some frustrations – the system "fell over" several times, although I am certain that this was due to my kludged hardware rather than the software.

In the course of subsequent daily operations, the system has clagged a number of times when using file manager or even the MS-DOS Prompt. I've learned not to attempt a file copy from the A: drive to the B: drive, though admittedly it sometimes works for short files.

File size seems to be a factor in whether or not the system will hang. Marking a group of files is a recipe for disaster, usually, but those same files can often be transferred one by one. Again, these problems must be located somewhere in my hardware or in the system setup.

Incidentally, this is a good place to point out that – if you have anomalous behaviour – don't make assumptions about the cause. Do not blame Windows for something that might be endemic to the system. The best test when something falls over is to stay at the DOS level and try to duplicate the behaviour.

"A quick skim gave me enough information to be dangerous & I started the installation. To my dismay, the first problem I encountered was that a CGA driver is no longer provided."

Drivers, drivers everywhere

Right – at this point, we have a more or less working piece of hard-

e. We've achieved disc operations ıe fundamental level, even if some he bells and whistles don't quite :k. Given the previous difficulties h the floppy drives, this is hardly prising.

The monitor is definitely marginal : is usable – just. The keyboard es what it's supposed to, except ıen it doesn't. Well, what would u expect from a definitely used key- ard? An occasional missed charac- · is no big deal and the problem can solved by throwing a little more oney at it. More on this later.

Since the serial card has already ɔen tested with the modem, I know I ın continue to communicate with ıe outside world. Ripper. The final nd perhaps most important periph- ral operation is hard copy. I've been sing a colour printer for several years nd blithely assumed it would be sup- ɔorted by Windows 3.1. There's a Microsoft Windows Version 3.1 Hard- ware Compatibility List included with he software package. This covers com- ɔatible computers (my Kludge Spe- cial wasn't listed, of course), displays, printers, networks, pointing devices and keyboards.

Perusing the list, I then discover the model I have is not included. Bummer! Lots of Brand X printers, just not mine. Now, one of the beauties of Windows is that you need install a printer once and the graphical environment handles the talking between applications and hard copy hardware. This is, however, contingent on having the right printer driver! We did try several likely possibilities, including a couple of Epson bog-standard types, without success.

Well, the X-42 (name changed to protect the guilty) is a bit long in the tooth but it is an 18-pin printer and has produced some reasonable hard copy from packages like Digital Research's GEM. I thought it would simply be a matter of getting the right driver; either Microsoft or the printer vendor was a possibility, I thought. Accordingly, I called my local Brand X dealer the next working day. They referred me to the Sydney office, giving me a 008 number. I tried that.

The telephonist understood my initial query easily. She put me straight through to the customer support officer. I explained the situation to him.

"Uh, Windows?" he mumbled.

"Yes."

"Three point one?"

"Yes."

"What model printer again?"

"X-42."

"One of ours?"

Well, I didn't get very far there. Next, I decided to call the Microsoft office in Sydney. A voice answered and I quickly explained the situation.

"Umm, tricky. I don't think I've heard of anyone else trying this. Let me just check the master list on the computer".

There was a long pause. It must be a big list! As the silence became uncomfortable, the technical support person (or whatever he was) said, "I'm just unzipping the file now." Then he added, idly, "Of course, three point one only supports 24-pin printers, you know. He then confirmed that the X-42 wasn't on the list and suggested that what I really needed was a new printer. Well, I hadn't argued the point but I knew after looking at the compatibility list that there were a number of 9-pin printers. Maybe his curious statement actually referred to Brand X printers and not all printers. Who knows? Who cares?

By now, I was thoroughly frustrated. Just at that point in time, I got a call from the software dealer. I raced down to pick up DOS 5.0 and pessimistically took my compatibility list with me. The sales rep was not surprised at my tale of woe. I said I was about desperate enough to buy a new printer. He thought that a bad move, since I was essentially satisfied with my existing hardware, if I could get it to

"The monitor is marginal but is usable – just. The keyboard does what it's supposed to, except when it doesn't. Well, what would you expect from a definitely used keyboard?"

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work. He offered further suggestions to trace a source for an appropriate printer driver. I was impressed with this since it really meant no money for them. Naught came of this, however, and in the end, I went back to the dealer and bought an inexpensive Epson.

Will it work?

The rep said he used one himself. I looked askance, knowing the bane of compatibility problems and pointed out that this particular model was not on the Microsoft list. "Use such-and-such," he said. "It works". Oh, before I continue, of course I was still able to get hard copy at the DOS level. And even under Windows 3.1, the "generic" driver functioned properly. It only meant the little advantages like TrueType fonts and other graphical bells & whistles weren't available.

"If I have any trouble, I'll be coming back with fire in my eye," I warned.

The plastic money got bent a bit further that arvo and I raced home. Installing the driver under the Windows operating system was not difficult. Foolishly, I didn't start at Square One. Yes, I know better. Why should I take my own advice? Instead, I went to a Windows application, called up a file I'd been working on and pointed it at the printer. WYSIWYG? No way. By now, I could recognise bit streams being interpreted wrongly.

Was it the driver? Even the Epson book verified what the sales rep had said. Curses, foiled again! I turned off the rig in disgust and watched Star Trek and went to bed.

The following morning, I did a systematic diagnosis. I verified the self-test of the new printer. It was good. I checked the software configuration of the printer itself, just in case. Nothing out of the ordinary there. Without even going into Windows, I did a straight DOS copy of an ASCII file to the printer. It had errors.

Not dramatic ones, to be sure. It took me a second to recognise what was wrong: no upper case characters. Just to double check, I did a hex dump and repeated the same process on the old Brand X printer. The conclusion was inescapable: a stuck bit in the interface electronics. Bah humbug, so much for the self-test earlier. At least I'd been able to eliminate the guesswork by a systematic approach.

I returned to the dealer with fire in my eye. When I walked through the doorway, several people dived for cover. The wimps sent one of the young women out to see me. I told her that I had to see the sales rep and they managed to drag him out of the back room. I showed him the printouts – with that inescapable evidence of hardware malfunction, I received a swap printer straight away.

Back home once again, I went through the entire process from the ground up. And of course, there was no problem at all. By the time I got into Windows and produced my first state-of-the-art hard copy, I felt like I'd been through a war.

"I returned to the dealer with fire in my eye. When I walked through the doorway, several people dived for cover. The wimps sent one of the young women out to see me."

Yet another upgrade

Just at this point in time, "me good ol' mate" decided he really needed a high-resolution non-interlaced monitor. With appropriate video driver card, of course. So I inherited one SVGA monitor with Tseng Labs card. It's a world of difference to see what you're doing, rather than interpolating it from a CGA monitor whose dot-pitch approximates S2 glasspaper.

Over the next month, I soared up the learning curve of MS-DOS 5.0, and the intricacies of Windows and various applications. It was evitable that missing keystrokes wc frustrate me to the point of buyi new keyboard. I smirked to my that nothing could go wrong in regard. Sure.

After all, there's only really a v few possibilities: the original XT-st (not mine) or the original AT st (nor again), the less common 32 type (definitely not mine), or the 1(key or PS/2 or enhanced keyboa You definitely can't interchange and AT types. Yes, your typical clo keyboard usually has a switch wi XT/AT positions.

My existing keyboard did have switch, did have 101 keys and sure any typical enhanced keyboard woul work. I discovered there was monthly computer swap meet on an attended the venue. Several dealer had attractive keyboards at even mor attractive prices. One word of advice here: do give a prospect a bit of a ru to see if you like the feel and sound There are wide variations.

I selected one and took it home Nothing can go wrong, I said ... of with the old, on with the new. I fired up the machine and knowing the CMOS did have the keyboard test installed, waited through the 35-second boot-up procedure. No error report, good! I typed "WIN" and waited whilst the operating system loaded. When I first started to do something, the system locked up.

Hey, what's this? I'd decided some time back to coin a new acronym: "I had to CAD out of Windows (again)". CAD? – Control-Alt-Delete, of course. Well, to my surprise, I couldn't even CAD. A poke on the Reset button solved that problem. I watched again through boot-up. Then I stayed at the DOS level. Tapping the keys got response. But when I hit either the Caps Lock or, on a subsequent test, the Scroll Lock, the appropriate LED came on permanently and the keyboard was locked up. Very, very strange.

The leaflet in the clone keyboard box referred to "the switch" and showed one of two possibilities, depending on whether it was "a type A or type B" keyboard. The unit itself, however, had no such switch; I'd already checked and assumed it was a standard enhanced unit.

I called the dealer. He'd never had a keyboard fault, naturally, but offered

wap it. I drove a considerable dis-
:e to his location and watched in
nay as he plugged "my" keyboard
) an ordinary 386 clone and it
:ked perfectly. Since I was already
re, he gave me another keyboard as
wap. Back home, it exhibited the
ıe symptoms!

At this point, I drove out to see my
ourite BBS sysop (hi Sandy!) and
: put this u-beaut new keyboard on
e of her many computers. It worked
st fine. I took a slightly used one
)m her in exchange – it did have a
/itch, set on the AT mode, of course.
ıd it works just fine on my system.
hy is this all so? I have no idea.

All I can say is that it points up the
ecessity for mix and match testing.
here's nothing like substitution to
)rt out these little problems. Swap-
ing one part and repeating a test is
ıe quickest and easiest answer.

Conclusions

What's the bottom line? It's been an nteresting time to be sure, with lots)f unanswered questions. At the end)f it, I have a reasonably inexpensive and mostly working platform. Did I save any money? If time is money, then the answer is unequivocally "NO!"

Using 20-20 hindsight to confirm things I generally knew anyway from past experience, here's a little list:

(1). Change one thing at a time.
(2). When in doubt, substitute.
(3). Cheap add-ons without documentation may be no bargain.
(4). Be systematic and thorough.
(5). Don't blame one thing when another may be at fault.
(6). RTFM – when all else fails, Read The Flamin' Manual.

The last is particularly important when confronted with little, niggling annoyances like too-easily accessible mains select switches on power supplies. Probably more units have blown up from inadvertently flicked switches than all the component failures or supply spikes put together!

And finally, keep smiling!

Editor's note: readers would do well to regard this and last month's story as a cautionary tale. Upgrading hardware in this piecemeal way can be frustrating, even to the most well-informed computer user. If you want a new computer and can afford the price, sell your old one, buy the new one and sleep well at night. **SC**

Intel Announces The Pentium

Intel Corporation has announced the production version of the Pentium® processor. Up to five times as powerful as the 33MHz 486 DX CPU, the fifth-generation Pentium processor extends performance while maintaining full compatibility with existing software.

The new processor will benefit areas such as scientific modelling, computer-aided design and engineering (CAD/CAE), large-scale financial analysis, and high-throughput client/server applications. The Pentium processor also will provide the increased performance necessary for applications such as voice recognition, imaging and real-time video.

The Pentium processor will be offered in 66MHz and 60MHz versions. The speed difference between the 66MHz and 60MHz versions is about 10%.

Manufactured using a 0.8µm BiCMOS process and designed using a superscalar RISC architecture, the Pentium processor has two 5-stage execution units and can process up to two instructions in a single clock cycle. Both the Intel 486 and Intel 386 have one execution unit. The Intel 386 is a traditional CISC design that utilises several clock cycles per instruction. By contrast, the Intel 486 CPU, designed with a RISC integer core, executes most instructions in a single clock cycle.

The Pentium processor features two 8Kb on-chip caches, dramatically improved floating point performance, and a 64-bit burst-mode external bus. It has 3.1 million transistors – nearly three times as many as the 486.

The powerful, fully compatible floating point unit (FPU) incorporates optimised algorithms and dedicated multiply, divide and add hardware, with an 8-stage pipeline to execute one floating point operation per clock cycle. The FPU is capable of running many applications 5-10 times faster than the same applications running on a 33MHz 486DX.

Other design techniques, such as branch prediction, 256-bit internal data buses and write-back caches, all serve to improve performance.

Not only will current software run on Pentium processors without modification and with substantial performance improvement, but new high-performance tools and compilers are available that will allow commercial and in-house developers to achieve even greater performance enhancements through a recompilation process, also known as optimisation.

Many major software developers have committed to optimising their current applications for the Intel architecture, while others are porting their high-end applications to the Intel architecture for the first time.

Peripherals

Intel is providing system building blocks to enable a variety of Pentium processor-based systems designed for high-performance desktop and server applications. These blocks include the 82496 advanced cache controller and 82491 cache, the 82489 DX interrupt controller, and the 82430 PCI set chip set.

The Pentium processor and second-level cache chip set, the 82496 cache controller and multiple 82491 custom SRAMs, are a tightly combined group of components optimised for high-performance desktop systems and two to eight-processor high performance servers. The 82489 DX, the first implementation of the advanced programmable interrupt controller (APIC) architecture, provides multiprocessor system support.

The Intel 82430 PCI set provides PCI local bus performance to Pentium processor-based desktop systems. It includes an integrated cache/DRAM controller, a local bus accelerator, and system logic with an EISA or ISA expansion bus bridge to enable a range of price/performance systems.

Intel has begun production of the new processor and expects to ship approximately 10,000 units in the second quarter of 1993.

AMATEUR RADIO

BY GARRY CRATT, VK2YBX

Kenwood's mighty little TH-28A & TH-78A transceivers

The old saying that "bigger is better" is n longer necessarily correct, as we can repor after checking out Kenwood's latest VHF/UH hand-held transceiver offerings

Kenwood has released two new identically-sized hand-held transceivers: (1) the model TH-28A covering the 2-metre band, with a 70cm receive facility; and (2) the TH-78A dual-band 2-metre/70cm unit. Both units offer an unbelievable range of features in such a small package.

In fact, the first impression one gets of either unit is that operating it will require hours of study and a degree in Electrical Engineering. In practice, nothing could be further from the truth – they're easy to use.

Designed to fit into the palm of the (Japanese) hand, both units are quite heavy, no doubt the result of the use of a diecast chassis. The units are supplied with a 7.2V 700mAh nicad battery pack which slides inside a protective cavity at the bottom of the unit. There are various power output levels available, all selectable by the user and dependent upon the capacity of the battery pack fitted. More on this later.

Left: the TH-28A 2-metre FM transceiver features dual-band receiver capability (VHF/UHF) & extensive multi-scan functions. The alphanumeric display allows the user to dedicate a 6-character identifier to each of 20 memory positions. Other features include a DTMF memory function for storing up to 10 different telephone numbers plus facilities for digital message transmission.

The array of features is comprehensive and, in addition to the standard features expected on any basic hand-held unit, includes programmable VFO tuning limits (allows the VFO to be programmed in 1MHz segments) and selectable RF output power settings of 5W, 2.5W, 2.0W, 0.5W and 20mW. These levels are dependent on the voltage and current rating of the power supply or battery used.

The provision of a transmit lockout function prevents accidental transmission on a dedicated receive channel, while an in-built timer (with a maximum period of 10 minutes) prevents the "stuck microphone" problem, often the cause of blocked FM channels and particularly annoying if the frequency in question happens to be a repeater input frequency.

One handy feature is the provision of a lithium microprocessor back-up battery which lasts for 20 days, even when the battery pack is removed. There are 40 user-selectable memories (50 in the TH-78A), ample for the number of dedicated FM channels in any capital city. However, the addition of the "ME-1" memory expansion unit increases this to 239 memories for those operators requiring additional capacity.

nother user friendly feature is the nory channel character display, wing the user to dedicate a 6-char- ır alphanumeric identifier (eg, 2RWI) to each of 20 memory posi- ıs. This is a particularly useful fea- ə if you are travelling interstate, as relevant repeater callsigns can be ered into memory, along with their quencies prior to departure. This minates having to refer to repeater ts and amateur radio handbooks.

For those wishing to scan parts of ə VHF and UHF bands, both models ovide nine separate scanning op- ons, including "band scan" which structs the receiver to scan from the west to the highest frequency limits ıd "memory scan" which instructs ıe receiver to scan all memory chan- els containing data. Unused memory hannels and those deliberately ocked out are skipped.

The "VFO/ memory scan" function nstructs the receiver to toggle between he last used memory channel and the /FO frequency. All scanning func- ions can be carrier or time interval ontrolled.

Phone patch capability

The DTMF memory feature allows telephone numbers of up to 15 digits to be stored. This is a handy feature for those involved in phone patch operations. The 3-digit dual tone squelch system (DTSS) allows squelch activation when a transmission encoded with the same 3-digit code is received. There are 999 user-selectable codes, and the duration of the code burst is extended from 250ms to 450ms to ensure reliable performance when you are using repeaters. Apart from numerals 0-9, the alphabetic characters A, B, C and D can also be used for repeater control.

This feature, when used with the paging and DTSS functions, forms the basis of a digital message system. A pager facility alerts the operator to an incoming call and the DTSS feature displays the ID number of the caller. In addition, up to 10 alphanumeric messages can be kept in memory for transmission as needed, by way of reply.

If the transceiver is left unattended, the last 10 digital messages (each up to six characters long) are stored in memory and can be recalled and displayed later. The "Time Alert" feature causes the transceiver to display the time the last message was received.

Cross-band operation is possible with both units, although the TH-28A has no transmit facility on the 70cm band. The TH-78A allows quite extensive cross-band operations, including full duplex cross-band operation, and has the ability to receive two frequencies within the same band at the same time (either VHF + VHF or UHF + UHF). By using an external speaker, both signals can be monitored simultaneously.

The TH-78A also comes equipped with the "automatic band change" function, enabling independent control of both UHF and VHF operation.

Both the TH-28A and TH-78A are equipped with automatic power off and battery saver functions, to maximise battery endurance. These features, combined with user selectable RF output power settings, assist in maximising the operating hours.

In addition, numerous optional accessories are available for both models. Specifically for the TH-78A, Kenwood Australia has available the PB-17 12V 700mAh high-power battery pack, the PB-18 7.2V 1100mAh long-life battery pack, various soft cases (dependent upon the battery pack used), the BT-8 alkaline battery carrier, the PG-3H filtered cigarette lighter cord, various speaker microphones, a VOX headset (HMC-2) and a water resistant bag (WR-2).

Many other options are listed and appear equally suitable for either TH-78A or TH-28A.

Specifications

As for the technical parameters of these units, we can report that both receivers met the stated sensitivity claim of 0.18μV for 12dB SINAD and exhibited good adjacent channel rejection.

Using an external 13.8V DC power supply, both transmitters drew 1.4A when operated in the high-power mode on 2-metres, while the TH-78A drew 1.5A on high power on the 70cm band. At the lowest power setting of 20mW, the TH-78A drew 120mA from the 13.8V supply.

For those interested, both units use a first IF of 45.05MHz for the 2-metre receiver and 58.525MHz for the 70cm receiver. Selectivity is quoted as 60dB at 28kHz which, considering the size of the units, is adequate for UHF/VHF operations.

The TH-78A has similar features to the TH-28A but is a full VHF/UHF dual-band transceiver that can receive two frequencies at the same time. A dual encoder provides independent control of the VHF & UHF bands.

At the recommended price of $549 for the TH-28A and $879.00 for the TH-78A, both units offer excellent value for money. They come complete with Kenwood's 12-month warranty and are available from authorised Kenwood outlets.

Acknowledgement: my thanks to Mr Yan Sabura of the Kenwood service division for his assistance in providing technical information for this article. **SC**

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The Story Of Electrical Energy, Pt.23

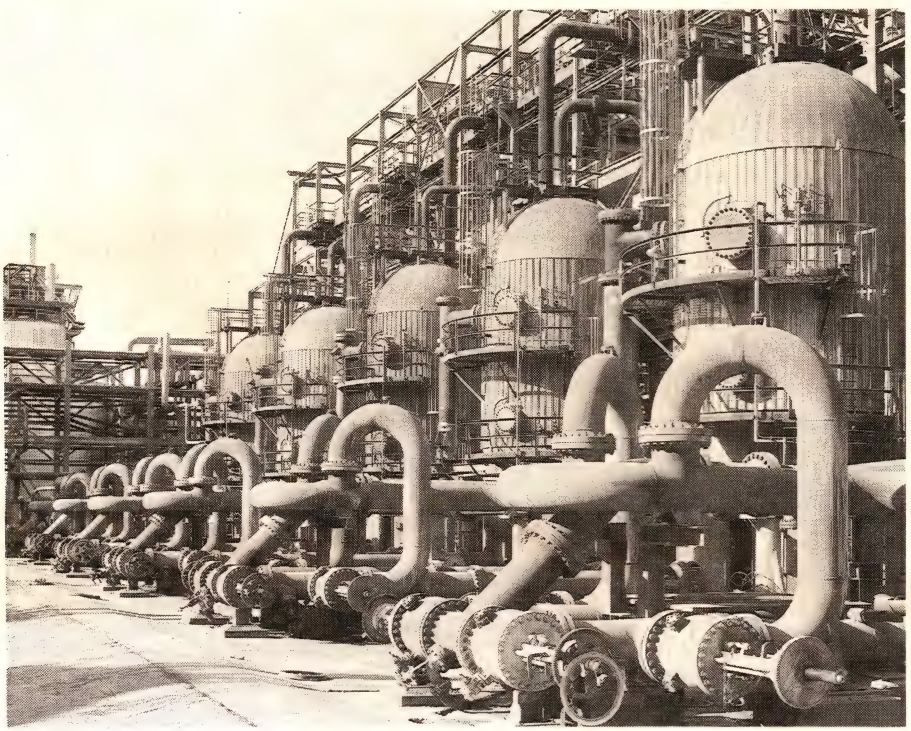
This month, we present the second story on the production of aluminium. We look at how alumina is separated from the bauxite ore in a chemical process which takes lots of energy, in the form of electricity, coal & natural gas.

By BRYAN MAHER

The Bayer process to extract alumina from bauxite ore and the Hall-Heroult process of electrolytic smelting of alumina to obtain the pure metal have remained the backbone of the aluminium production industry for over 100 years. However, many advances have been made in these process and the amount of energy needed has been significantly reduced.

Australia is the biggest producer of alumina in the world and much of our production is shipped to smelters in other countries. Alumina and bauxite together rank fourth (after coal, wheat and wool) in Australia's annual exports.

Worldwide, nearly 100 million tonnes of bauxite are refined annually by the Bayer chemical process.



These are the digesters & flash tanks. The digesters dissolve the bauxite in caustic soda under conditions of high pressure & temperature. The flash tanks then produce considerable amounts of steam as the resultant slurry is reduced to atmospheric pressure in several stages.

And the world's largest refinery ha pens to be the Queensland Alumi Ltd plant at Gladstone in Centr Queensland. This plant is run by tl consortium QAL (Queenslan Alumina Ltd), formed in 1967. In tially, CRA joined with Kaiser Al minium of the USA to form the Con monwealth Aluminium Corporatio (later renamed Comalco) in 1956 t develop the Weipa bauxite deposits.

In choosing a site for the alumin refinery, Weipa was considered firs but rejected as unsuitable. The presen site at Parson's Point, Gladstone wa purchased in 1963, leaving room fo future expansion. Alcan of Canada and Pechiney of France then joined the consortium and construction of the alumina refinery commenced.

The original Gladstone plant was designed to produce 360,000 tonnes of alumina a year but immediately plans were put in hand to upgrade it to 600,000 tonnes.

From 1967 to 1973, three further expansions of the plant took place. The third expansion increased the production of alumina to 2,400,000 tonnes per year, a sevenfold increase on the original design.

Today the plant produces 3,325,000 tonnes of alumina annually, employs a workforce of 1200 and receives eight million tonnes of bauxite by ship from Weipa each year. To refine this ore, 630,000 tonnes of caustic soda and 140,000 tonnes of limestone are required.

The alumina produced is shipped to aluminium smelters in Tomago, NSW; in Bell Bay, Tasmania; and in New Zealand, the USA and Canada. Alumina ore is also sent by conveyor belt to the giant smelter at nearby Boyne Island.

The Bayer process

In 1888, the Austrian chemist Karl Bayer discovered that alumina could be dissolved in a solution of sodium

oxide (caustic soda), given suffi-
tly high temperature and pres-
. Thus, the Bayer refinement proc-
is essentially one of dissolving
nina in caustic soda to separate it
1 the other chemicals in bauxite,
then crystallising the alumina
n the solution after the red mud
been settled out.

A typical analysis of bauxite is 50%
minium oxide, 12% ferric oxide,
silicon dioxide, 3% titanium ox-
, 0.03% alkalis and 0.01% chlor-
s, plus small quantities of gallium
d rare earth metals.

The alumina contained in bauxite
ay be either the monohydrate form
oehmite ($Al_2O_3.H_2O$), or the tri-
drate type Gibbsite ($Al_2O_3.3H_2O$).
ie deposits at Nhulunbuy are 98%
bbsite, while the Weipa field has
parate deposits of both types, the
oehmite predominating. The refin-
ig plant at Gladstone has been de-
gned to accept both types of ore, but
eparately.

Grinding mills

The bauxite ore is first ground in
even two-compartment combined
od/ball mills. These mills are the
argest electro-mechanical units in the
lant, with motors ranging from
1.2MW to 1.6MW.

Because the grinding mills run continuously, synchronous motors are preferred. These motors draw a leading power factor from the electricity mains. This is used to compensate for the lagging power factor drawn by induction motors elsewhere in the plant. Thus, the overall system power factor is improved which means better utilisation of the Gladstone power plant and the overall distribution system.

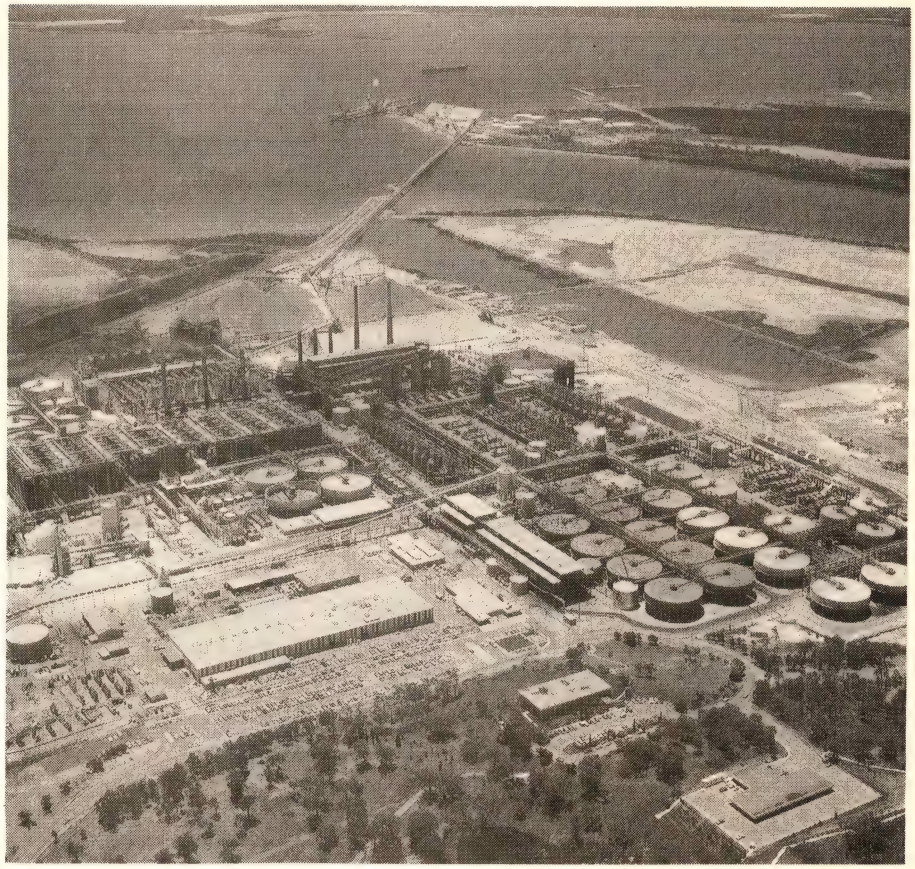
A 10% solution of caustic soda in water is added in the mills to form a thick slurry which is pumped out to the pre-treatment tanks. These are heated to allow silication to take place. The silica products pass out through the system as sodium aluminium silicate waste compounds.

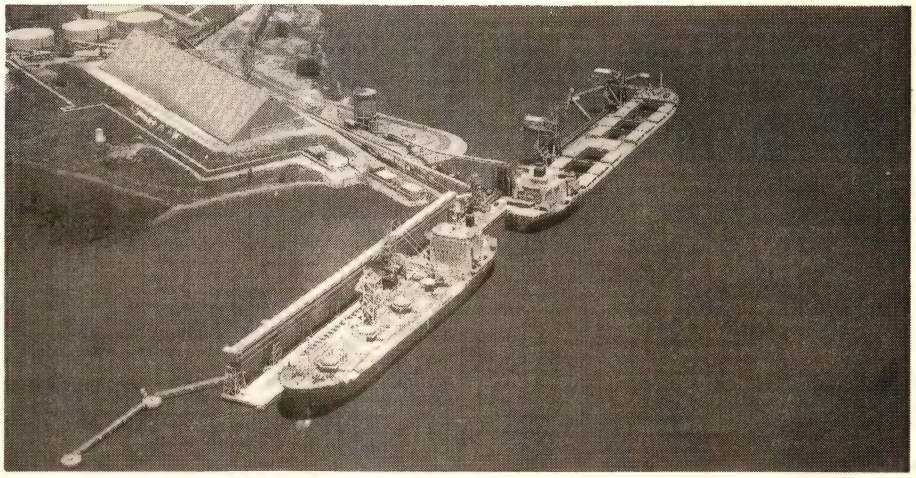
High-temperature digesters

From the pre-treatment tanks, the caustic/bauxite slurry is pumped into high temperature digesters where steam is injected to heat the mixture to above 240°C. To prevent boiling, the digester tanks are pressurised vessels, operating above 3500kPa (about 500 psi). Under these conditions and with agitation, the bauxite breaks up. The alumina content dissolves in the caustic solution, while the iron oxide and other minor compounds remain as solids in suspension.

After digestion, 70% of the bauxite mass is in solution in the caustic liquor, while the remaining 30% undissolved waste takes the form of a thin red mud suspension. This liquor is now flash-cooled to atmospheric boiling temperature and pressure. Considerable amounts of steam are generated as the pressure is reduced in stages down to atmosphere and this steam is used later in the process to preheat the liquor coming from the settling tanks.

The final steam condensate is returned to the Gladstone power station boilers as feed water and some is used





These two aerial photographs show the extent of the world's largest alumina refinery at Gladstone in Queensland. It produces over three million tonnes of alumina each year.

These are the huge rotary kilns which dry the alumina slurry after crystallisation has taken place. The kilns are continuously rotated by 200kW induction motors through a multistage gearbox & are gas fired to 1100°C.

for washing the red mud waste from the settling tanks.

Sweetening

The more soluble trihydrate type bauxite lode at Weipa is separately mined and shipped to Gladstone. Passing through its own grinding and pretreatment facility, the Gibbsite is easily digested at lower temperatures and the additional bauxite slurry is injected into the main stream in the flash tanks to maximise the alumina content in the liquor. This mixing, called sweetening, occurs at a point where the stream temperature is below 200°C.

The red mud waste is extracted from the liquor stream by holding it in large horizontal settling tanks. The clarity of the liquor is improved by adding flocculants to accelerate settling.

The overflow from the mud settling tanks, after further filtering, becomes the wanted clear liquor. This is now a hot super-saturated solution of alumina in caustic soda and water. It is cooled by flash evaporation, by subjecting it to a partial vacuum. This also generates lots of steam and this is recycled to heat the spent liquor stream returning to the digesters.

Crystallisation of alumina

The dissolved alumina in the form of sodium aluminate is recovered from the clear filtered liquor by seeded crystallisation. This occurs in a series of vertical tanks 30 metres in diameter. Sodium aluminate crystallises out to give trihydrated alumina plus caustic soda. The cooled pregnant liquor flows to rows of agitated precipitation tanks which are seeded by introducing crystals of solid trihydrate alumina.

The liquor is held in each tank for about three hours before passing on to the next. The whole crystallisation process takes 25-30 hours, producing crystals of various sizes along the way.

The sizing of the crystals is a carefully controlled process. The liquor entry temperature into the crystallisation tanks, temperature gradient across each tank, seeding rate, caustic soda/water concentration and holding time are all vital in the control of crystal size.

The crystalline alumina trihydrate is removed from the tanks by an auger feed and the crystals are separated into three size ranges in gravity classifiers. The major coarse fraction is the wanted product to be smelted later while the smaller crystals are used as seeds in the crystallisation tanks.

The overflow from the classifiers is the spent caustic soda solution. This

-concentrated by evaporating the
ɜr, heated and then recycled back
ıe digesters, to begin the whole
ɔess cycle again.

fter the gravity classifiers, the
nina trihydrate slurry is treated to
ove both combined and free wa-
This is done by passing it through
ɜries of calcinating units. First in
line is a circulating fluidised bed
ciner and then nine rotary kilns,
h four metres in diameter and 100
tres long.

These huge kilns are rotated by
0kW induction motors, driving
ough a multistage gearbox. The
ns are gas fired to 1100°C, to re-
ove all free and combined water
m the alumina.

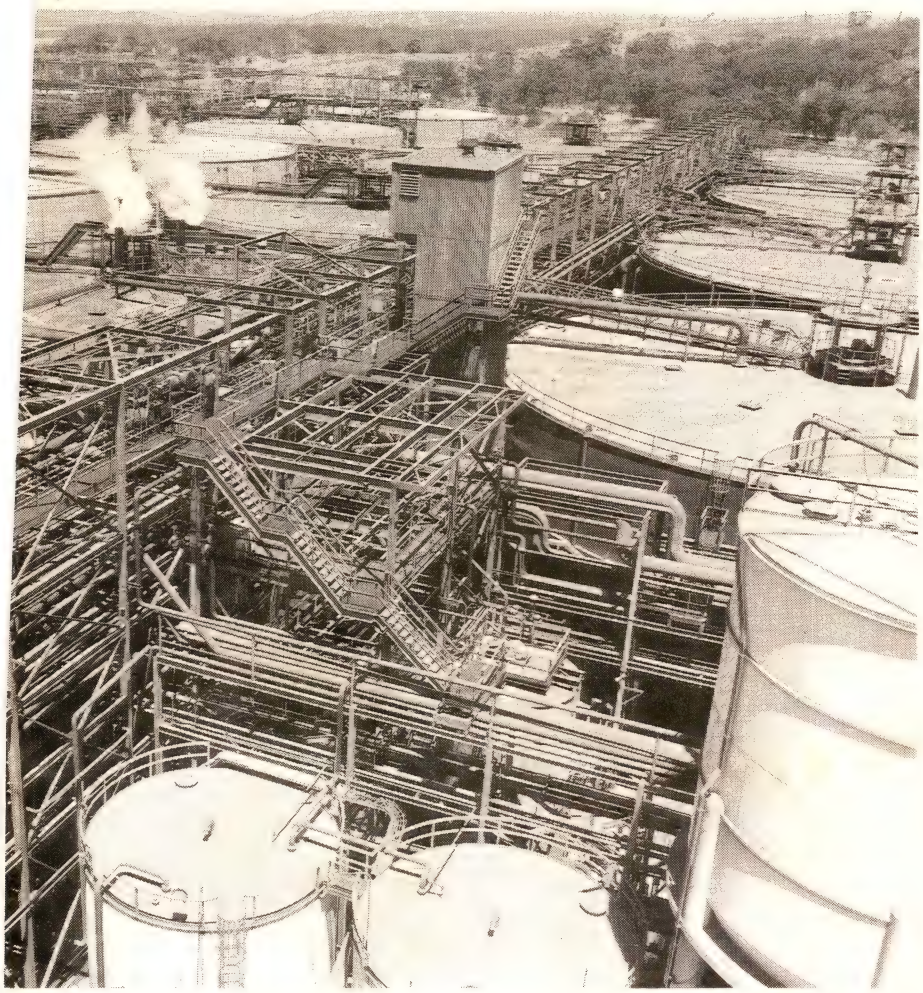
After cooling to below 90°C, the
ished product – dry, sandy, white
umina – is stockpiled in enclosed
orage buildings. Conveyor belts then
ɪrry the product either to the over-
ɜas shipping wharf on South Trees Island, or overland to the Boyne Island Smelter.

Naturally, the whole process is subject to computer control. Electronic sensors monitor all temperatures, pressures, flow speeds, bauxite input rates, liquor concentrations and other parameters at hundreds of points in the plant, and send all data on-line to one large central computer. This optimises output and minimises energy requirements.

Next month we shall look at the most energy intensive stage in the production of aluminium – the smelting of the alumina. SC

Acknowledgements

Special thanks for photographs and data to Queensland Alumina Ltd; Noel Wootton and Eric King; and to C. A. Kneipp and Nabalco.



As in any modern chemical plant, there are countless large tanks & hundreds of kilometres of piping. The 40-metre diameter tanks in the foreground are settling tanks, used to separate out the red mud from the caustic soda solution.

A.J&J Coman

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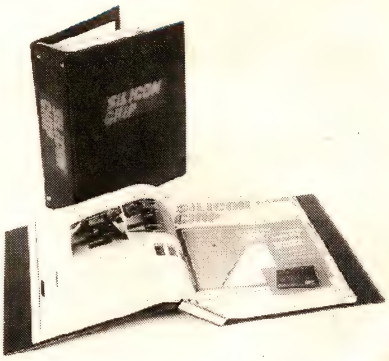

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Camcorder audio mixer has high bandwidth

I am writing regarding the Audio Mixer For Camcorders published in the March 1993 issue of SILICON CHIP. First, allow me to congratulate you on a useful project which I'm sure will prove to be very popular. It is a wonder such devices are not more common, although I suppose most people would be using a studio type mixer to incorporate 'outside' audio on their sound tracks.

However, I am curious as to why the upper frequency cut-off is so high at 72kHz. Wouldn't the circuit provide superior performance if this was lowered to just above the human hearing range, or has this been done in order to keep the gain lower and thus prevent distortion? (S. M., Heidelerg, Vic).

• The upper frequency cut-off of the mixer at 72kHz is more or less arbitrary. However, if you bring the cut-off frequency down too much you will inevitably reduce the flatness of the response above 15kHz while making no audible improvement in the residual noise.

How to detect end of charge for nicads

I am writing to obtain information about a 7.2V peak detection circuit for nicad batteries. The circuit is needed for a fast charger with the peak detector detecting when the cells have taken a full charge and then reverting over to trickle charge, to give the cells the optimum charge possible. Any information would be of great assistance. (B. C., Campbelltown, NSW).

• Detecting the end-of-charge point for a nicad battery is not a simple matter since the voltage itself is precise – it is affected by the temp ture of the cells. In fact, what happ is that when the cells reach the e of-charge point, the voltage actua takes a small dip. Hence, the det tion circuit needs to switch at this rather than at a precise voltage.

We have published two circu which you may find useful in dete ing end of charge: (1) the Megaf Charger in June 1988; and (2) the F Nicad Charger in the January and Fe ruary 1991 issues. The first circ was fairly simple while the secor circuit used a digital-to-analog co verter and was more precise.

On the other hand, if you just wa a simple circuit to detect a 7.2V thres old, you will find a precise circuit i the Nicad Battery Discharger feature in the November 1992 issue of SIL CON CHIP.

Tacho for 2-cylinder motor

I would like to use the Digital Tachometer featured in the August 1991 issue of SILICON CHIP in conjunction with a 2-cylinder outboard motor. I understand that I would need to use a different value for resistor Rx to make it suitable for a 2-cylinder motor but I am not sure how to do the calculations. Can you help me? (B. A., Brookvale, NSW).

• Resistor Rx sets the gating time for the counter and, as noted in the article, is varied according to the number of cylinders in the motor. However, not stated in the article was the assumption that the circuit would be used with a 4-stroke motor.

For a 4-cylinder 4-stroke motor, the number of sparks per revolution is two; for a 6-cylinder motor, it is three and for a V8, it is four. However, a 2-stroke motor has twice as many power strokes per revolution as a 4-stroke. Hence, a 2-cylinder 2-stroke motor has the same number of sparks per rev as a 4-cylinder 4-stroke motor.

Therefore, if your motor is a 2-stroke, Rx should be the same as specified for a 4-cylinder engine – ie, 82kΩ. If the motor is a 4-stroke, change Rx to 150kΩ and follow the calibration procedure given in the article.

However, there is one other factor to consider. If your outboard motor is a 2-stroke, it will probably use a magneto-driven capacitor discharge ignition, with one coil for each cylinder. In that case, the tachometer circuit should be connected to the primary of one ignition coil and therefore you will be measuring one spark per revolution. In that case, change Rx to 150kΩ and proceed as outlined above.

Surround sound decoder wanted

I would be very interested if you were able to publish a Dolby® Pro-Logic Surround Sound Processor, preferably one that can feed the existing amplifiers that I have. As you may be aware, there is substantial promotion of the 5-speaker surround sound systems currently.

Could you also advise whether the speakers that are now advertised as being suitable for placement close to television sets have been specially designed so as to avoid interference with the television picture, or whether they are conventional speakers that have been shielded in some way? I am interested in the process involved, in part because I have a number of excellent speakers which I wish to use for surround sound close to a television set and would like to be able to provide some kind of magnetic shield if this is possible. (H. P., Balwyn, Vic).

• It is unlikely that we can publish an article on a Dolby®Pro-Logic Surround Sound Processor, since the Dolby®

c chips are only available to li-
sed manufacturers.

is not possible to magnetically
ld existing loudspeakers. Speak-
for use close to TV sets have their
gnets shielded with an additional
gnet and shroud assembly which
ıcels any leakage magnetism from
main magnet. The only way is to
y speakers which have been mag-
tically shielded during manufac-
e.

ow to combine wo TV antennas

I noted the question from A. S., of enmark, WA, on how to combine gnals from two antennas for chan-el 2 and channel 9. This is easily one by purchasing a Hills, Kingray r Telebrite high-band/low-band VHF iplexer, with AC pass on the high-and input. These devices are in very ommon use in this area, where we ıave local channel 3, plus channels 7,) and 10 from Sydney; exactly the ame situation as described. All the ompanies mentioned are Australian, although Taiwanese diplexers are also available. We have found the latter to be very lossy, as well as unreliable. (P. M., Maitland, NSW).

Advice on sinewave inverter

I am building the 2kW Sinewave Inverter published in the October 1992 to January 1993 issues of SILICON CHIP. Since I can't afford the kit price I have designed my own PC boards and have sourced parts separately. However, the one part I do not have yet is the sinewave table ROM. Is this ROM available separately?

In case it isn't available, I have written a "C" program to generate the sine table. To do so, I have had to make several assumptions: (1) switching frequency of 4kHz, therefore 8192/40 timeslots (in 10ms) = approx 205 memory locations plus 250µs (4kHz); (2) deadband time of four memory locations between D6 and D5; and (3) resolution of 180/40 = 4.5 degrees, therefore sine table in steps of 4.5 degrees.

Are these assumptions correct? If not, could you please correct me or send the ROM contents. I also need the full design details of the main inverter transformer as I have purchased the ferrite core and all the other parts. Congratulations on an excellent design. (B. M., Canterbury, NZ).

• Your assumptions about the sinewave table in the ROM are essentially correct. There are also some subtleties which allow for the fact that saturation in the IGBTs can cause flattening of the sinewave when the duty cycle approaches 100%. However, as noted several times in the series of articles, the design copyright of this project is owned by Rod Irving Electronics. This means they also own the ROM contents.

We suggest that you approach this company direct (phone 613 543 2166) to obtain a copy of the ROM. They may also be able to supply details of the transformer but it is really not a job for the do-it-yourselfer. It is a very difficult transformer to wind.

Cruelty to (electronic) insects

I liked the look of the Electronic Cockroach published in the March 1993 issue so I pulled a few wings and legs off it to produce a simple circuit. I used it to run my Lima test bogie and was pleased to see it run with 1.5V or less across the terminals, where previously 2.3V was a good starting voltage. It was also no longer sensitive to where the brushes happened to be at start-up.

We are out of Johnson 170 motors here, so slot car motors and 24V motors from a UBix copier were tried. These were good at low speed but there is too much feedback, hence circuit B which is to be tried next. It was meant as an auxiliary Railpower controller but my Railpower is on indefinite loan/assessment. I'm feeding it from a 6/9/12V DC plugpack which I have found in the past cuts out if you use a 2200µF electro for smoothing. Therefore, poorly regulated DC is being fed to a 1000µF capacitor and thence to a 12V regulator. There could be some beating between the pulse frequency and the 100Hz ripple superimposed on the DC input. (D. W., Christchurch, NZ).

• Thanks for your comment regarding your modified cockroach but if you want it as an auxiliary Railpower why not go to the source and modify the Railpower instead? It will give better speed control. A suitably ab-

Shopping for old radio parts

I enjoy reading the Serviceman's Log and the Vintage Radio column every month. I have collected a number of old radios and have restored them but I require a few parts to complete them and I was wondering if another reader may be able to help me.

I require a dial glass, a handle and retaining screws for a HMV model 600 or 601 portable radio. I also need a control knob, a speaker lead with a 2-pin plug and a button for earth shielding for a 1951 Astor FK-6181 6V car radio.

Now I may be able to help other readers. I built the 0-45V, 8A power supply described in the January and February 1992 issues of SILICON CHIP. The only trouble I had was that I wired switch S2 the wrong way around. After fixing this it worked fine. But when I used it a couple of weeks ago, it cooked the toroidal mains transformer secondary winding due to a shorted FB2502-35 bridge rectifier.

I fixed the transformer by rewinding the secondary with 15 gauge B&S wire and by replacing the bridge rectifier with a new unit rated at 100 PIV and 35A. I also put a 10A fuse in one leg of the secondary winding, so this should now blow instead of cooking the transformer. Yes, it is shutting the gate after the horse has bolted. No, the fuse in the mains line did not blow; this is why I put in the new fuse. (Keith Lang, PO Box 174, Esperance, WA).

• We agree that a fuse in the secondary is probably a good idea. However, we think that a value of 10A may be too low and could be inclined to blow at switch on or when the supply is delivering full current. With that in mind, a 10A "slo-blo" fuse may be a better choice.

Casualties in a Studio Twin Fifty

Can you please help? I have just completed building the Studio Twin Fifty Amplifier from Jaycar's kit. I checked the circuit visually and with a meter before applying power and could not discover any misplaced components. On power up, all test voltages were nominally OK although the voltages across the 0.47Ω 3W emitter resistors varied from 8mV to 11mV and the output offset voltage seemed a little high at about 33mV.

I also had a problem setting the quiescent current which would slowly rise, stabilise, then slowly start to rise again. However it would eventually appear to stabilise and was set at this level. I also noticed that this seemed to be temperature related, as blowing on the heatsink would cause it to fall.

The amplifier was run for a couple of hours with a source and output connected and, even at high volume levels, the heatsink did not become too warm.

The problem occurred when the amplifier was left idling for about two hours. The heatsink became almost too hot to touch. I turned it off and let it cool down a little, then turned it on and applied a source. The fuses in each channel blew, as did Darlington transistor TIP147 (Q9) in the left channel (the right channel seems OK).

I wonder if you could suggest any reason for the above fault and also nominate any other components that may have been damaged. I have tested all as far as my limited knowledge will allow and all seem OK. Is this a common fault, or have I missed a Notes and Errata on this project, or have I done something wrong in construction? (D. E., Ceduna, SA).

• From your description, it seems likely that there is a problem with the quiescent current monitoring circuitry involving Q7 in one or both channels. Is this transistor in good contact with the main heatsink and have you used heatsink compound on both sides of the mica washers of all transistors which are mounted on the heatsink?

There have been few instances of problems with this kit and certainly none that could be regarded as common.

breviated form of the circuit was published on page 15 of the August 1992 issue of SILICON CHIP.

Making PC boards with a photocopier

Following the breakthrough in this area by Glen Andersson in the February 1993 issue (page 25), the following method applies the same principle but using a photocopier instead of a laser printer. I start with a full size PC artwork (usually the solder side view in a magazine) and I set the photocopier for the darkest yet clear imprint on some test papers and then I make a copy on a transparent plastic sheet. The special thermal plastic sheets for photocopying are available from drawing supply/art shops at about $1.00 for an A4 sheet and these can be cut in half (150 x 200mm) to copy small PC boards.

Now use the transparent copy but with the artwork facing upwards so that this now becomes the component view copy master. Make a copy of that master using another sheet or half sheet of the transparent plastic, or as many copies as you want PCBs.

On a wire rack in a domestic convection/microwave oven, place a very flat and rigid plate of metal, glass or ceramic tile. On top of this place the copper PC blank with polished side up (steel wool and no finger prints as usual), then one of the new reverse transparent copies (carbon side down, solder view facing you), then 20 or more squares of flat newspaper to act as a pressure pad, then another thick piece of flat material, then a house brick for applying pressure.

Set the oven to convection and 150°C for 50 minutes or perhaps one hour if glass or ceramic plates have been used. Leave everything intact to cool down overnight. Using this method, I have found that about 95% of the pattern has been reproduced onto the PC board. I then touch up imperfections with an etch resist pen and etch the board in the usual way.

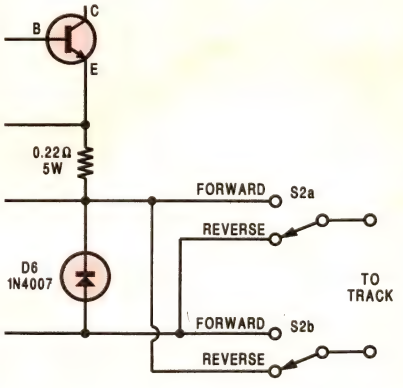
Most people can access a photocopier at a library or business, and convection/microwave is not too common nowadays, so to my way of thinking messy developing chemical and darkroom work are now unnecessary for most hobbyists. I could be wrong but having made my first etched PC board in 20 years of dabbling in electronics, and with little fuss at that, this method must surely represent a breakthrough. (G. H., Doubleview, WA).

• While we have yet to try this method, it does seem as though it could work quite well. However, we must issue a few cautions. First, make sure that any transparency film you use is suitable for the photocopier you have access to. Generally, the film packet should have a long list of copiers on it that are suitable. Some copiers are not suitable for use with plastic transparency film, as it can damage the drum. If that happens, the repair bill could run to $700 or more so be warned.

Second, don't even think about using metal plates in the way described in a normal microwave oven and don't use a microwave/convection oven in microwave mode. If you do and a metal plate is used, you run the risk of blowing the oven's magnetron. On balance, we think it would be better to use a conventional oven.

Notes & Errata

Traffic Light Simulator, February 1993: the wiring diagram on page 25 shows the two ICs oriented in the wrong direction. In addition, the circuit of the train controller on page 27 shows incorrect connections to the polarity changeover switch, S2. It should be wired as shown in accompanying diagram.



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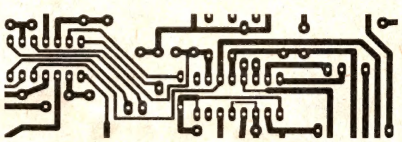

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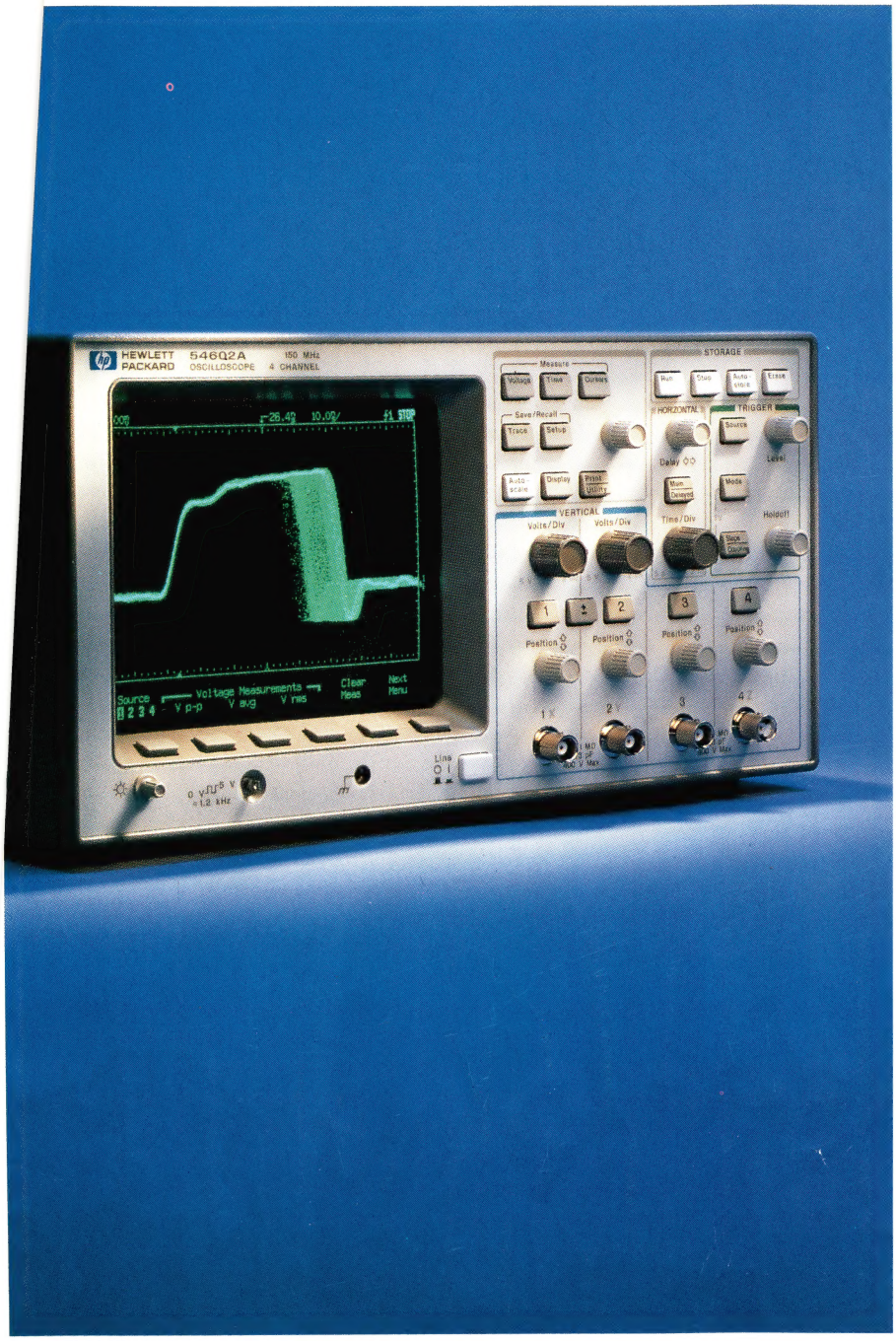

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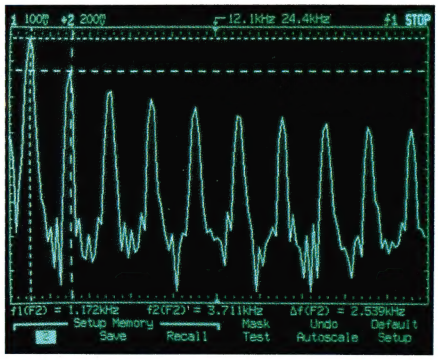

FFT is just one of the advanced waveform viewing tools you'll get with the HP54657A/58A Measurement Storage Module.

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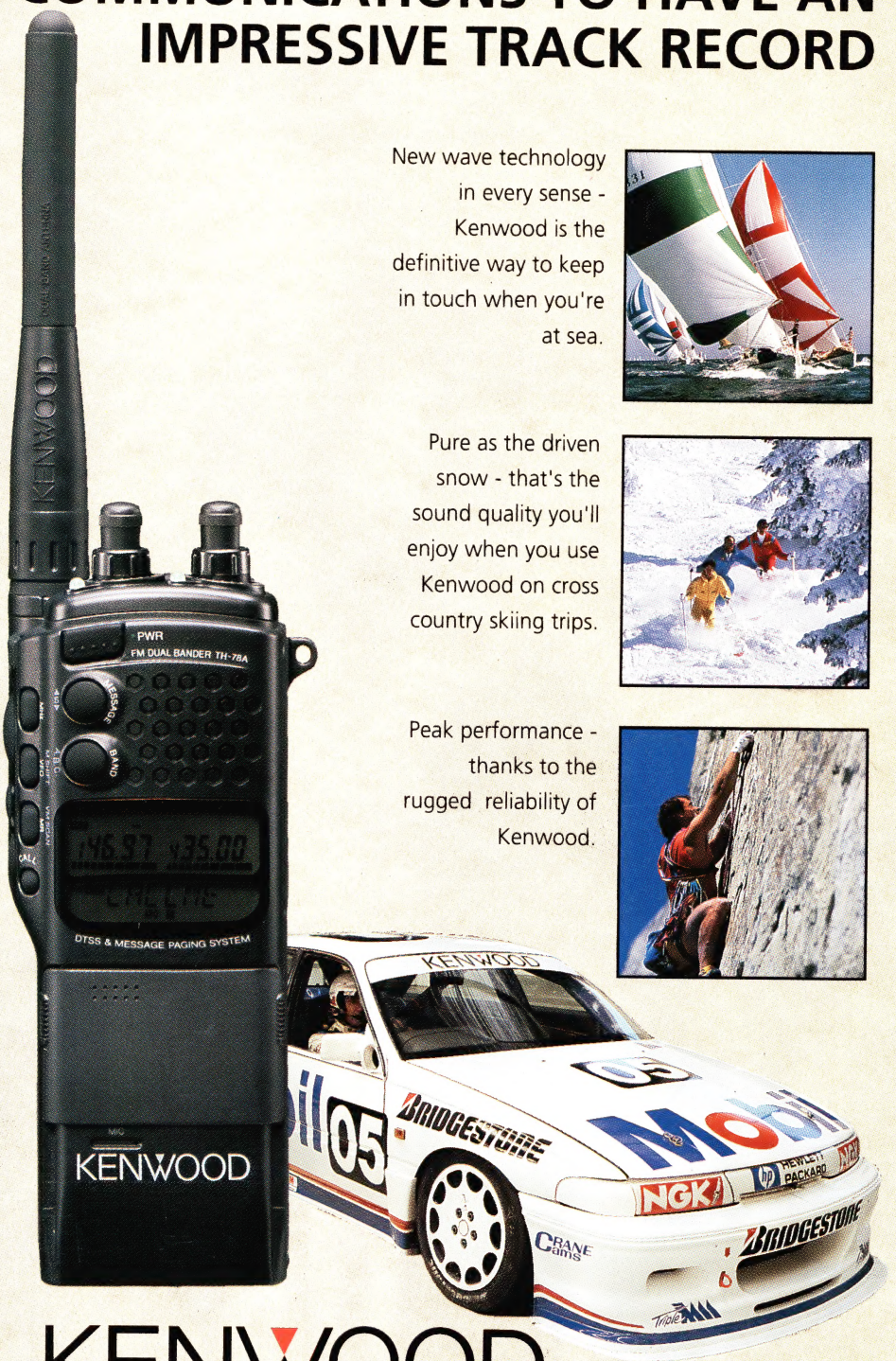

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